ATTACHMENT 1 – FIELD SAMPLING PLAN

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SUPPLEMENTAL MINE WASTE ROCK DUMP AND FACILITY SOIL AND VEGETATION CHARACTERIZATION

FIELD SAMPLING PLAN

Revision 3

June 8, 2009

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ACRONYMS AND ABBREVIATIONS

A/T	Agencies and Tribes
AWRA	Area Wide Risk Assessment
COPC	Contaminant of potential concern
DQOs	Data Quality Objectives
dw	Dry Weight
FSP	Field Sampling Plan
ft	Feet
ft^2	Square feet
GPS	Global Positioning System
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
i.e.	*id est* (Latin, that is to say; in other words)
IDFG	Idaho Fish and Game
e.g.	*exempli gratia* (Latin, for example)
mg/kg	Milligrams per Kilogram
MWH	MWH, Inc. (formerly Montgomery Watson Harza, Inc.)
P4	P4 Production, L.L.C.
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SI	Site Investigation
SOP	Standard Operating Procedure
USDA	United States Department of Agriculture
USFS	United States Forest Service

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1.0 INTRODUCTION

This FSP details the work scope for waste dump and facility cover material surveys and collection and analysis of soil and vegetation samples at P4 Ballard, Henry, and Enoch Valley Mines (the Site). This FSP is an attachment to the *Supplemental Mine Waste Rock Dump and Facility Soil and Vegetation Characterization Sampling and Analysis Plan*. The SAP presents the DQOs that have been developed to guide the sample collection program presented in this FSP. The complementary document to the FSP is the QAPP, which is also an attachment to the SAP, as is an updated HSP.

The FSP is organized as follows:

Section 1 – Introduction

Section 2 – Program Background: provides a brief summary of information related to the need for the soil and vegetation sampling event, and information on the available historic data

Section 3 – Investigation Objectives, Approach, and Rationale: presents the sampling objectives and sampling design rationale

Section 4 – Characterization Activities: specifies the field surveying and sampling activities

Section 5 – Sample Collection and Analysis: summarizes protocols for all sample collection and handling procedures and sample analyses and laboratory methods

Section 6 – Project Organization: presents the project team, schedule, and deliverables

Section 7 – References

2.0 PROGRAM BACKGROUND

This section provides brief background information related to soil and vegetation characterization at Ballard, Henry, and Enoch Valley Mines. Additional program background details may be obtained from the 2004 Site Investigation work plans (MWH, 2004).

The sampling program presented in this FSP was specifically requested by the Agencies and Tribes (A/T) in a 2 May 2008 letter to P4 (IDEQ, 2008a), in which the A/T identified data gaps that need to be filled to satisfy objectives of the site investigation. In this letter, the A/T indicated that additional sampling of soil and vegetation at all potential source areas should be conducted. Generally, the A/T concluded that upland soil and vegetation are among the primary risk drivers at the site, and that prior data were not sufficient to address the data gap in part because they have not been shown to be consistent with current data quality protocols and COPCs.

The conclusion that dump soils and vegetation may be a primary risk driver is largely based on previously collected data from P4 and other mines in the areas. The previously collected upland soil and vegetation samples from Ballard, Henry, and Enoch Valley Mines were collected in 1998, 2000, 2001, and 2004 as part of area-wide and mine-specific investigations. Riparian soil and vegetation samples were also collected in 2004. A summary of the number of samples collected is provided in Table 2-1. While the A/T have determined that these data cannot be the basis of the SI, these data may supplement the data collected in accordance with this FSP once data validation and data usability assessments of the historic data are completed. These past data may provide valuable supplementary data to support risk assessment and remedial alternative selection. However, the data collection program presented herein will provide a comprehensive data set that is consistent between the three mines, individual sources, and background areas. In addition, the data collection program outlined in this FSP will be consistent with current A/T guidance on COPC selection.

Table 2-1: Historic Soil and Vegetation Sampling Summary

Soil

	July 1998	Summer 2000 (Enoch Valley Dump Characterization)	Spring 2001	Fall 2001	July 2004 (mass wasting and agronomic)	Sept. 2004 (Riparian Soil)		
	MWD080 (BM) - 5	MWD091 (EVM)	MWD080 (BM) - 1	MWD081 (BM) - 3	MWD080 (BM) - 4	MDS016	MSP011	MSP020
		MWD092 (EVM)	MWD081 (BM) - 1	MWD086 (HM) - 3	MWD082 (BM) - 29	MDS022	MSP012	MSP021
			MWD085 (HM) - 1		MWD084 (BM) - 1	MDS025	MSP013	MSP022
			MWD086 (HM) - 1		MWD085 (HM) - 26	MDS026	MSP014	MSP023
			MWD090 (HM) - 1		MWD086 (HM) - 26	MDS030	MSP015	MSP031
			MWD091 (EVM) - 2		MWD091 (EVM) - 52	MDS031	MSP016	MSP055
			MWD092 (EVM) - 1			MDS032	MSP017	MSP059
						MDS033	MSP018	MSP062
						MSP010	MSP019	
Total Samples	5	133	8	6	138	26		

Vegetation

	July 1998	Summer 2000 (Enoch Valley Dump Characterization)	Fall 2001	2004 (monthly, May-Oct)[a]	July 2004 (mass wasting)	Sept. 2004 (Riparian Veg)		
	MWD080 (BM) - 5	MWD091 (EVM)	MWD081 (BM) - 3	MWD081 (BM) - 6	MWD082 (BM) - 26	MDS016	MSP011	MSP020
	MWD089 (HM) - 5	MWD092 (EVM)	MWD086 (HM) - 3	MWD086 (HM) - 6	MWD085 (HM) - 26	MDS022	MSP012	MSP021
				MWD091 (EVM) - 6	MWD086 (HM) - 26	MDS025	MSP013	MSP022
					MWD091 (EVM) - 52	MDS026	MSP014	MSP023
						MDS030	MSP015	MSP031
						MDS031	MSP016	MSP055
						MDS032	MSP017	MSP059
						MDS033	MSP018	MSP062
						MSP010	MSP019	
Total Samples	10	84	6	18	130	26		

Notes;
The numbers following each dump ID represent the number of samples taken from that dump during that event.
a - One composite sample was taken from each dump at the same quadrat, every month for six months, resulting in 18 total samples.
BM - Ballard Mine, HM - Henry Mine, EVM – Enoch Valley Mine

3.0 INVESTIGATION OBJECTIVES, APPROACH, AND RATIONALE

The general objectives of the field investigation are two-fold. First, a survey will be conducted that will identify soil and vegetation cultural significance, relative abundance, and community; and survey potential source areas to identify the type of cover material or soil. The second component will characterize the nature and extent of contamination in surface soil and terrestrial vegetation at potential source areas for the COPCs. These data will be used to compare potential source areas to adjacent background areas, support risk assessment, and support selection of future remedial actions. The specific need for the type and quantity of data are identified in the DQOs contained in the SAP. This section provides the general approach for addressing the DQOs and associated rationale where needed.

3.1 Survey of Culturally Significant Vegetation

This task is a data gap identified by the A/T in their 2 May 2008 letter (IDEQ, 2008a) and is needed to support a risk assessment. The survey will be conducted in all potential source areas. These potential upland source areas are discussed in Sections 3.2 and 3.3 below.

The following list of culturally significant plants was developed by the Agencies and Shoshone-Bannock Tribes. The survey will focus on these plants in the potential source areas.

- All water plants (e.g. water cress, mint)
- Aspen
- Bitterroot
- Camas
- Carrots (upland)
- Chokecherry
- Conifers
- Currents
- Gooseberry
- Huckleberry
- Junipers
- Onions
- Raspberry
- Red willows (ten bark)
- Sage tops
- Strawberry
- Sweet milky white
- Tullees (bull rush)
- Turnips (upland)

3.2 Identification of Potential Source Areas

The survey of potential source areas will be used to refine the spatial boundaries of the soil and vegetation characterization effort. The following source areas were considered for characterization:

- waste rock dumps (internal and external)
- mass wasting areas
- miscellaneous fills
- haul roads (inactive)
- open pits (not backfilled)
- stockpiles
- sedimentation areas
- historic mine facilities

Initial evaluations have identified the following as potential source areas to be included in the soil and vegetation characterization effort:

- waste rock dumps (internal and external)
- partially backfilled pits
- open pits (not backfilled)
- historic ore haul roads
- active ore haul roads (excluding the off-site haul road at this rime)
- Ballard Mine shop area
- Enoch Valley Mine tipple area

The following features are not considered likely source areas:

- mass wasting areas
- miscellaneous fills
- stockpiles
- sedimentation areas
- access roads (not haul roads)
- Henry and Enoch Valley mine facilities

The rationale for exclusion of the six areas listed above is given below.

Mass Wasting Areas

Areas where waste rock dumps have expanded due to mass wasting were identified in 2004 and during additional site reconnaissance performed in 2008. This information was used to redefine the dump boundaries; therefore mass wasting areas are included in the footprint of the corresponding waste rock dumps and characterized as waste rock dumps. In general, mass wasting has not significantly expanded the dump boundaries.

Miscellaneous Fills

No miscellaneous fills have previously been identified. If any are discovered during survey activities, they will be included in the footprint of corresponding waste rock dumps or inventoried as new waste rock dumps, and characterized accordingly.

Stockpiles

Only two stockpiles are present. One stockpile is the ore stockpile at the Enoch Valley Mine tipple. This is an active facility with the material in the stockpile continually being removed and replaced. The closure and reclamation of the stockpile is included in the Enoch Valley Mine plan. In addition, this stockpile will not be present when this area is ultimately closed. Thus, the stockpile is not included in the soil and vegetation characterization work at this time. Characterization work may occur at a later date when the area is no longer active.

An active stockpile of calcium silicate slag is also present at the Ballard Shop area. This material is actively used for road surfacing and repair. Similarly, this pile will be eventually removed and is not considered part of the inactive facilities.

Sedimentation Areas

As noted in Section 2.0, sampling of soil and vegetation has been conducted at sedimentation areas such as seeps and ponds on the potential source areas. Thus, these areas are not included in the soil and vegetation characterization work at this time. Any other sedimentation would be considered mass wasting and part of the waste rock dumps.

Access Roads

Occasional unimproved roads cross the mine waste dump areas to access sampling and reclamation monitoring locations, fence lines, and for other uses. These roads are minor landscape features, and the material exposed in the wheel tracks is no different than the surrounding material with the possible exception of being slightly more compacted and often largely unvegetated. These areas are not considered substantially different than the surrounding terrain, and therefore, they are not included as a separate source area.

Henry and Enoch Valley Mine Facilities

Similar to the tipple stockpile at the Enoch Valley Mine, the other mine facilities at the Enoch Valley Mine are currently active supporting ongoing mining at the South Rasmussen Mine. These facilities will be characterized and reclaimed under agency oversight when that mining ends. The current conditions are dynamic and may not be representative of long-term conditions. Therefore, these active facilities are not considered herein for characterization. The exception is the tipple area perimeter which will have reconnaissance sampling conducted as part of this FSP. The Henry Mine facilities have been reclaimed. This reclamation consisted of burial of the facility areas with waste rock and cover materials and revegetation. The cover material overlaying the closed mine facilities in the Henry Mine area will be included as part of the waste rock dump area characterization.

3.2.1 Description of Potential Upland Source Areas

A brief discussion of planned soil and vegetation characterization efforts, at each potential source area, is given below. Specific details relating to survey and sampling activities are given in Section 4.0. Table 3-1 lists the size of each potential source area included in the characterization effort. Additional information pertaining to the physical characteristics of the source areas will be obtained, including volume, material at depth, aspect, and age. This information was identified as a data gap by the A/T. In their 2 May 2008 letter to P4 (Rowe 2008a), the A/T determined that additional information describing the physical characteristics of the source areas was needed for future development, screening, and analysis of cleanup alternatives.

Table 3-1: Potential Source Areas							
Potential Source Area	Mine	ID	Name	2D Area (sq. ft.)	2D Area (acres)	3D Area (sq. ft.)	3D Area (acres)
Waste Rock Dump	Ballard	MWD080	Ballard Mine Pit #1 Overburden Dump #1	3,520,000	81	3,670,000	84
	Ballard	MWD081	Ballard Mine Pit #1 Overburden Dump #2	2,060,000	47	2,180,000	50
	Ballard	MWD082	Ballard Mine Pit #3 Overburden Dump	3,170,000	73	3,330,000	76
	Ballard	MWD083	Ballard Mine Pit #4 Overburden Dump	727,000	17	760,000	17
	Ballard	MWD084	Ballard Mine Pits #5 and #6 Overburden Dump	1,270,000	29	1,320,000	30
	Ballard	MWD093	Ballard Mine Pit #2 Overburden Dump	2,860,000	66	3,030,000	70
	Henry	MWD085	Henry Mine North Pit Overburden Dump	2,850,000	65	2,890,000	66
	Henry	MWD086	Henry Mine Pit #1 Overburden Dump	12,100,000	278	12,400,000	285
	Henry	MWD087	Henry Mine Pit #1 Canyon Fill Dump	3,760,000	86	3,870,000	89
	Henry	MWD088	Henry Mine Pit #2 Overburden Dump	3,190,000	73	3,260,000	75
	Henry	MWD090	Henry Mine South Pit Overburden Dump	4,340,000	100	4,480,000	103
	Enoch Valley	*MWD091*[a]	*Enoch Valley Mine North Dump*	*8,910,000*	*205*	*10,500,000*	*241*
	Enoch Valley	MWD091N	*Enoch Valley Mine North Dump #1*	4,270,000	98	5,750,000	132
	Enoch Valley	MWD091S	Enoch Valley Mine North Dump #2	4,640,000	107	4,750,000	109
	Enoch Valley	MWD092	Enoch Valley Mine South Dump	10,600,000	243	10,800,000	248
Partially Backfilled Pit	Ballard	MMP035	Ballard Mine Pit #1	805,000	18	840,000*	19*
	Ballard	MMP036	Ballard Mine Pit #2	TBD	TBD	---	---
Historic Ore Haul Road	Ballard	MHR001	Ballard Mine Historic Haul Road South	12,680 ft Length	---	---	---
	Henry	MHR002	Henry Mine Historic Haul Road Central	16,200 ft Length	---	---	---
Historic Facility	Ballard	MBS001	Ballard Mine Shop	260,000	6	---	---
Active Facility	Enoch Valley	MAR001	Enoch Valley Mine Active Haul Road South	11,000 ft Length*	---	---	---
	Enoch Valley	MTA001	Enoch Valley Mine Tipple Area	1,300,000	30	---	---

Notes:
Calculated areas and volumes have been rounded to three significant figures.
a = MWD091 has been divided into two areas: MWD091N and MWD091S.
* = Estimated value
TBD = To Be Determined
--- = not applicable

Waste Rock Dumps

A total of 14 waste rock dumps at Ballard, Henry, and Enoch Valley Mines are included in the characterization. For this effort only, Enoch Valley Mine waste rock dump MWD091 has been split into two areas separated by mine pit MMP045. The size of each dump is given in Table 3-1 and the locations are shown on Drawings 1, 2, and 3. A survey of material and vegetative cover will be performed and relative percent coverage will be visually estimated. Information pertaining to pertinent physical characteristics of the dumps will be obtained and when necessary, the dump boundaries portrayed on the drawings will be refined. Soil and vegetation samples will be collected from 10 randomly selected quadrats on each of the waste rock dumps.

Partially Backfilled Pits

Open pits that have been partially backfilled but have not been inventoried as waste rock dumps may support vegetation even though they are un-reclaimed. Areas that may fit this scenario are the north end of pit MMP035 and pit MMP036 in Ballard Mine. These partially backfilled pits will be further delineated as needed (Drawing 1). The boundaries of the partial backfills will be verified during the material cover and vegetation survey. Soil and vegetation samples will be collected from 10 randomly selected quadrats on each of the partially backfilled areas similar to the waste rock dump sampling protocol.

No other pit backfills that could be considered as individual dumps are known in the Ballard Mine area. Other backfilled mine pits at Henry and Enoch Valley Mines are contiguous with their adjacent waste rock dump and because of reclamation the pit backfill is not distinguishable from the dump.

Open Pits

Open pit source areas include open mine pits that have not received any backfill and mine pits that have been partially backfilled but are not yet included in the waste rock dump inventory. Both types of pits will be surveyed for areas supporting vegetation before soil and vegetation sampling commences.

The majority of areas within open pits, that have not received any backfill, do not support vegetation because they are barren rock exposures or areas of actively unraveling pit slope talus rock deposits. Other than very sparse patches of plants or individual plants that can grow in loose rock, no vegetation has been previously observed in these pits. However, if there are areas supporting vegetation that is not backfilled waste rock, and the areas are large enough to be attractive to grazing animals the A/T will be notified and an assessment will be made as to how to best incorporate the areas into the sampling program. These areas are not anticipated to be extensive and may require a unique sampling approach. However, the default approach will be collection of five judgmental reconnaissance samples representing the diversity of the soil and plant species present. Areas previously sampled for riparian studies of ponds will not be included.

Unique features of both the open and partially backfilled mine pits need to be considered when determining if sampling can be safely conducted. Only stable slopes less than angle of repose and with good footing will be included as part of a sampling quadrat and the sampling location must be a safe distance from the base of pit high walls. Work will not be conducted within 20 feet of a highwall debris or talus apron (the area where rock falling from the highwall has landed and settled), or one half the height of the highwall away from the highwall base, whichever is greater. If there is any question regarding the safety of approaching the base of a highwall, P4 mining and safety personnel will be consulted.

Historic Ore Haul Roads

Some former haul roads travel over waste rock dumps. These roads have been reclaimed along with the dumps and contain the same type of cover as the dumps. One such road is the reclaimed haul road that extended to the north end of the Enoch Valley Mine. These reclaimed haul roads are considered part of the waste rock dump areas and are included in the sampling program as dumps. Other, historic haul roads that have not been reclaimed or cannot be considered as part of a dump will be characterized separately.

Two former haul roads, one in the Ballard Mine area and one in the Henry Mine area, will be sampled (Drawings 1, 2, and 3). It is expected that the road base is not made of waste shales but more durable chert and similar rock. However, there is not definitive data on the COPC content of the road base material. Each former haul road will be sampled by randomly selecting 10 quadrats along the length of the roadway. A road quadrat will be 200 feet of road length by the width of the road including shoulders. Samples will be randomly selected within the quadrat using the same procedures as the waste rock dumps. However, if the section of road is paved, sample locations identified within the paved area will be moved to the mid-point of the nearest shoulder. If the road is paved and shoulders are unvegetated, an alternate sample location will be selected. For example, some sections of Henry road are cut through small hills and the shoulders are unvegetated, bedrock roadcut.

Historic Mine Facilities

The Ballard Mine shop has been identified as an active mine facility. It is currently being used for storage in the warehouse area and externally for drilling supplies and other items. This includes a stockpile of coarse (granular to pebble sized) calcium silicate slag that is used for chip seal on the current haul road, and other road surface repair. The majority of the Ballard Shop area is either buildings or parking lot constructed of the slag. The parking lot, buildings, and slag stockpile will not be sampled. A soil and vegetation survey of this area will be conducted to determine if soil and vegetation areas are present. If an area supporting vegetation is present and large enough to provide vegetation samples, five judgmental discrete grab soil and vegetation samples will be collected. The samples will be selected to cover the range of species and soils present.

Active Mine Facilities

The ore stockpile at Enoch Valley Mine is an active area that will eventually be reclaimed as part of the mine closure plan. The area will not be characterized at this time; however the margins of the tipple area will be sampled to obtain preliminary data. A soil and vegetation survey will be conducted to determine if soil and vegetation are present along the margins of the tipple area. One judgmental grab sample will be collected from five areas identified in the survey. An attempt will be made to space the samples evenly around the tipple area but also to represent the variety of species present along the perimeter.

The active haul road at Enoch Valley Mine has not been reclaimed and is used to access the South Rassmussen Ridge Mine and a portion is occasionally used for accessing the southeast side of Enoch Valley Mine. The road base is routinely graded for maintenance; however the berms are typically not substantially disturbed which allows for some sparse vegetation growth. The road will eventually be reclaimed as part of the mine closure plan; therefore, only the berms of the road will be sampled at this time. The samples from the berms will be used as preliminary data and additional characterization may be conducted when this road is reclaimed or if the judgmental grab samples indicate that additional sampling is need to conduct a risk assessment. One grab sample (five point composite from an appropriately sized quadrat based on berm configuration) will be collected from five vegetated areas identified in the survey. An effort will be made to space the five areas evenly along the length of the berm and to represent the diversity of material vegetation present. Additional samples may be collected if the area is highly variable.

The active haul road used to transport ore from the Enoch Valley Mine tipple to the Monsanto Plant will not be sampled. The active road will not be sampled, in part because of safety issues, but also because the roads will be reclaimed as part of facility decommissioning once the South Rasmussen Mine is closed. Characterization of soil and vegetation quality may be conducted after the road is reclaimed.

3.3 Selection of Background Areas

Background sampling areas have been selected for all three mine Sites to address A/T concerns regarding their proximity to the mine areas. The criteria for background areas selected are: (1) the area must be undisturbed by mining or waste rock disposal; (2) the area should be representative of the geology of the area where external waste rock dumps are placed at the mines; and (3) the area should be comparable in areal extent to the mine waste rock dumps being sampled . Similar sized areas will be used so that the area being characterized is comparable to an area where waste rock could be deposited, and the variability of the data is similar to what would occur in an actual waste rock dump area prior to dump construction. In addition, areas uphill from existing waste rock dumps or upwind of the prevailing wind direction are given preference. A minimum 200 foot buffer between the existing waste rock dump and the background area was also used. However, during the soil and vegetation sampling, observations will be made for presence of any mine related disturbances. Any quadrat that falls within a questionable area will be dropped and a randomly selected substitute will replace it.

The selected background area(s) for each mine are given below. Only a few areas are present that meet the criteria for a background area in the relatively close proximity of the mines; therefore, a pool of locations are not available to draw upon. Should these areas prove not to be acceptable after the soil and vegetation survey, the Caldwell Canyon site will need to be utilized and an addendum to this FSP will be prepared.

Ballard Mine

At Ballard Mine, a background area along strike of the mine pit and dumps on the east side of the mine was selected. This area is located to the northwest of MWD084, is not downgradient of mine disturbances and is directly comparable to the area containing the MWD084 waste rock dump (Drawing 1).

Henry Mine

Two background areas were selected for Henry Mine. The primary area is located in the north Henry Mine area, near MWD085 (Drawing 2). This area is down valley from the mine waste dump and the former Henry haul road transects the area. This area will be carefully assessed during the soil and vegetation survey for its appropriateness as a background area. At a minimum, the area 200 feet either side of the haul road will not be utilized as background. If there is uncertainty as to the appropriateness of the north Henry area, the secondary area will be utilized. The secondary background area is in central Henry Mine in a gap in the external waste rock dump MWD088. This area is located uphill or lateral to mine dump areas and also contains underlying geology similar to the adjacent dump areas. This area was not selected as the primary area because the geomorphology (a relatively steep hill) is different than the areas typically used for external waste rock dumps. Areas further to the east could be used, but are likely to be overlying dissimilar geology compared to the existing external dump areas.

Enoch Valley Mine

At the Enoch Valley Mine, a gap in the center of the mine area between external waste dumps will be used as background (Drawing 3). This area does contain some current mine facilities and roads. A 200-foot buffer will be used around these features. A quadrat located within the buffer zone will be replaced by another randomly selected quadrat. Overall, this location is directly comparable to the ground beneath the external waste rock dumps to the northwest and southeast and is along the geologic strike (i.e., is on the same geology as the dumps).

3.4 Determination of Representative Vegetative Media

Samples of herbaceous, above-ground vegetation will be collected at all selected potential source areas. <u>Woody vegetation, when present within the same quadrat, will be sampled separately from herbaceous vegetation. Samples of roots will be collected only from culturally significant vegetation whose roots are typically consumed by humans.</u> <u>At select locations as described in Section 4.2, plant samples will be separated as grasses, forbs, and woody vegetation, and forbs from these locations will be re-sampled in the fall to address potential seasonal increases in concentration.</u> The typical vegetation community found on the potential source areas is described in Section 3.4.1 below. <u>The foraging preferences of herbivores and omnivores, including mammals and upland bird species will be considered when sampling aboveground vegetation. Typical diets of large ungulates such as elk, deer, moose and cattle and discussed in Section 3.4.2 and Appendix A.</u>

In addition, COPC transport by wind from the inactive facilities is not considered a completed pathway to be investigated. Due to the reclamation and age of the closed facilities, dust generation is not currently observed. Dust consumption from vegetation will be accounted for during the risk assessment when incidental ingestion of soil is considered. Vegetation samples will be submitted as they would be consumed. With the exception of some culturally significant plant, the samples will not be rinsed.

3.4.1 Vegetation Communities and Available Forage at Ballard, Henry, and Enoch Valley Mines

Ballard Mine

The Ballard Mine was in operation from 1952 to 1969, and has been successfully reclaimed for the technology that was available at the time. State and Federal reclamation laws did not come to being until 1977, yet the Ballard Mine has had some of the pits partially backfilled and seeded, and most of the overburden dumps have also been seeded, except for a couple small areas of angle of repose with minimal to no vegetation. The reclamation seed mix at Ballard primarily consisted of Smooth Bromegrass (*Bromus inermis*), Orchardgrass (*Dactylis glomerata*), Western Wheatgrass (*Pascopyrum smithii*), Pubescent Wheatgrass (*Elytrigia intermedia ssp trichophorum*), and Alfalfa (*Medicago sativa*). At the time, Ballard was the industry showcase for reclamation practices because of the US Forest Service (USFS) plots that were established on the northwestern portion of the mine (MWD080) in 1968-1969. These plots were used to evaluate vegetative success of different planting mediums (shales v. soils), different fertilizer rates, and irrigated v. non-irrigated. Besides the plots, woody plants such as Colorado blue spruce (*Picea pungens*), Lodgepole pine (*Pinus contorta*), Siberian pea (*Caragana arborescens*), and Lilac (*Syringa*) were also planted. These trees and shrubs are only in a few select areas (mostly MWD080) and represent approximately 1% of the plant species on the landscape. Over the past 40 years there has been some Antelope bitterbrush (*Purshia tridentata*) that established themselves on the reclaimed areas, but because of the competitive nature of the grass species in the seed mix, less than 1% of the vegetative cover consists of bitterbrush. It would take a concerted effort to locate the species for sampling, and therefore does not seem to be justifiable for a species that is so sparsely established. Of the other tree and shrub species previously mentioned as part of the USFS plots, the only use by ungulates, such as mule deer, has been for cover, rather than browse. The combined vegetative cover for the woody species in the USFS plots and the native shrub species is approximately 1% or less of the landscape at Ballard Mine. This estimation will be confirmed during the vegetation survey.

Henry Mine

The Henry Mine was in operation from 1969 to 1989, and has had mine pits adequately backfilled and vegetated, as are the areas of external waste rock dumps. The reclamation seed mix at the Henry Mine primarily consisted of Smooth Bromegrass (*Bromus inermis*), Orchardgrass (*Dactylis glomerata*), Pubescent Wheatgrass (*Elytrigia intermedia ssp trichophorum*), Western Wheatgrass (*Pascopyrum smithii*), Timothy (*Phleum pretense*), Alfalfa (*Medicago sativa*), and Sainfoin (Onobrychis viciaefolia). There are no angle of repose slopes on the overburden areas at the Henry Mine, and reclaimed slopes are well established with approximately 3,000 pounds of forage per acre, as was determined by Dr James Kingery and his graduate students during the Grazing Study in the mid-1990s. Because of the competitive nature of the mostly introduced seed mix at the Henry Mine, the reclaimed areas have the appearance of lush pastures. Over the past 20-30 years, Antelope bitterbrush (*Purshia tridentata*) has established itself on the reclaimed areas, but they are very minimal and would occupy less than 1% of the vegetative cover at the mine. In 1989 there were about 20-30 bare root Lodgepole pine (*Pinus contorta*) planted along the east edge of the final pit (MMP043) at the north end of the mine. The remaining 15 or so plants are only about 2-3 ft tall and make up much less than 1% of the vegetative cover. As was the case with the Ballard Mine, the Henry Mine is similar in that reclaimed areas consist of primarily introduced grass and legume species with minimal competition from the native shrubs. The combined percent cover of the few remaining Lodgepole pine and the sparse encroachment of bitterbrush is still less than 1% of the total cover.

Enoch Valley Mine

The Enoch Valley Mine was in operation from 1989 to 2004 and has the most diversity of plant species on reclaimed areas, compared to the previous two mines. In the 1970s and 1980s, it was the norm to have thick stands of only a few introduced grasses, while in the 1990s the driving force behind reclamation seed mixes was plant diversity. More native and introduced grasses and forbs were added to the seed mix rather than thick stands of only a few species. The primary species found on reclaimed areas at the Enoch Valley Mine consists of Western Wheatgrass (*Pascopyrum smithii*), Great Basin Wildrye (*Elymus cinereus*), Mountain Bromegrass (*Bromus marginatus*), Orchardgrass (*Dactylis glomerata*), Bluebunch Wheatgrass (*Pseudoroegneria spicata ssp spicata*), Lewis Blue Flax (*Linum lewisii*), Kentucky Bluegrass (*Poa pratensis*), Pubescent Wheatgrass (*Elytrigia intermedia ssp* *trichophorum*), Small Burnet (*Sanguisorba minor*), Alfalfa (*Medicago sativa*), Rocky Mtn Penstemon (*Penstemon strictus*), Timothy (*Phleum pretense*), and Sainfoin (*Onobrychis viciaefolia*). During the life of the Enoch Valley Mine there was also better use of direct haul and stock piled topsoils, in which both Antelope bitterbrush (*Purshia tridentata*) and Mountain big sagebrush (*Artemisia tridentata*) could be seen re-establishing, as well as encroachment from adjacent native lands. The percent cover from both of these species is still relatively low at about 1% as it is sparsely distributed across reclaimed areas of the mine. Beginning in 1994 through about 2003, approximately 2,000 Quaking aspen (*Populus tremuloides*) seedlings were planted on reclaimed areas at the mine each year. However, aspen seedlings are difficult to establish and the long-term drought though the 1990s and into 2000s, along with competition from the grass species hindered the establishment of the aspen to where the overall success rate was about 1-2% at best. Also in 1994, there were 1,200 bare root Lodgepole pine (*Pinus contorta*) planted on a portion of north facing slope on the 1992 overburden dump, as well as on an east facing slope of the 1993 pit backfill (both areas are considered MWD092). Of those 1,200 trees planted, only about 300 remain and range in size from about 6-12 feet.

In summary, the predominance of bitterbrush and sagebrush is limited to the few areas where direct haul topsoil was used, and the predominance of aspen trees is limited to the few survivors that were able to establish themselves. The pines planted in 1994 are limited to only two small areas of the entire reclaimed lands and only appear to be used by elk and deer as antler rubs. Of the three mines under the AOC, the Enoch Valley Mine would be the only one where woody species sampling should be considered, but the overall percent cover occupied by woody plants is still relatively low at approximately 2%. Designing a sampling regime for woody plants at the Enoch Valley Mine does not appear worthwhile because of the low overall abundance of these species on the reclaimed landscape.

3.4.2 Foraging Habits of Wildlife and Cattle

A literature search was conducted to determine the foraging habits of wildlife and cattle that may forage on source areas. The literature search, including brief summaries and reference lists, is included in Appendix A.

Dietary information obtained from the USDA Forest Service FEIS database and Idaho Fish and Game (IDFG) indicate that the primary food source for grazers and browsers common to the area is comprised of the above ground biomass of grasses, forbs and shrubs, with preference and consumption dependent on the species present and seasonal availability. Although data from IDFG indicate that moose are known to consume root biomass of some tree and wetland species, these species are not found on the site and are not a plant component in the upland terrestrial vegetation characterization. Additional information on the dietary habitats of browsers and grazers (Bailey, 1984) state that herbivores feed mainly on plant species and parts of plants (buds, leaves, flowers, fruits) in which nutrients are concentrated. For browsing animals, diet is usually best when animals can eat only the terminal portions of the plants since most of the nutrients in browse occur in the buds and terminal-most portions of the stems. In situations where food becomes scarce, animals can resort to consuming more of the stem portions of the browse, but are still limited to the above ground portions of the plant.

Under saturated conditions, plant roots can be dislodged from the soil and ingested; however this would be highly unlikely at the mine sites, which typically have unsaturated soils where the upland terrestrial plant species are found. As a result of site-specific soil conditions and known grazing habits of wildlife users, marginal root consumption is expected at the mine sites. Therefore, sampling of roots to evaluate exposure of wildlife is not necessary.

The animals will likely choose grasses over woody vegetation on a seasonal basis. During the growing season, the grasses used for reclamation at the mines will be more prevalent than woody vegetation. During snow cover, woody vegetation will be the primary forage; however animals are not expected to winter on the reclaimed areas because there is scarce woody vegetation habitat for both protective cover and food source. However, there may be some browsing of woody vegetation (shrubs), and sampling of shrubs will be conducted for assessing risk to animals feeding on source areas at the mines.

3.5 Determination of Representative Soil Media

The A/T have indicated that to evaluate risk associated with recreational uses, specifically associated with all-terrain vehicle usage, a 0-6 inch soil sample depth is needed. This sample depth addresses the potential for rutting off-road trails. This requirement was conveyed to P4 in an email from Mike Rowe, IDEQ on 30 May 2008 (IDEQ, 2008b).

4.0 CHARACTERIZATION ACTIVITIES

This section describes the field activities that will be conducted. The activities are divided into two groups: survey activities (Section 4.1) and sample collection activities (Section 4.2).

4.1 Survey Activities

Activity 1 –Survey Culturally Significant Vegetation at Source Areas
The range scientist conducting the vegetation survey will visually survey each potential source area listed in Table 3-1. The presence of any culturally significant plant species described in Section 3.1 on mine waste dumps or other areas evaluated (e.g., inactive haul roads) will be recorded, along with an estimate of the species relative abundance. If any evidence of human use of such plants is observed, such evidence will be recorded. This activity will be done concurrently with Activity 2.

Immediately following the vegetation cover survey, P4 will submit a list of the culturally significant plants found to the A/T. This list will be used to identify any unique plant characteristics that would provoke modification of the general sampling protocol presented in Section 5.0.

Activity 2 – Survey Material Cover at Source and Background Areas
Prior to the soil and vegetation sampling (Activities 4 and 5) the material cover will be classified according to the following categories:

- topsoil stockpile
- topsoil cover
- brown shale
- cherty shale
- black shale

Other similar categories can be defined if those listed above do not include everything encountered.

Classification of soil at the background areas, will be conducted in accordance with SOP-NW-9.0a, *Soil and Waste Rock Dump Cover Material Classification Specific for P4 Production, LLC. Site Investigation* located in Appendix B.

Relative abundance of cover will be classified as follows:

- dominant – 50 to 100% of area
- abundant – 25 to 50%
- common – 10 to 25%
- uncommon – 5 to 10%
- rare – 0 to 5%

The soil survey of each source or background area will be conducted simultaneously with the vegetation survey, so a two-man team is needed with one person being a soil scientist or geologist and the other being a range scientist, or botanist. The level of resolution of the survey is the entire source or background area. The team will spend sufficient time observing each area in order to thoroughly characterize it as to categories present and associated relative abundances.

For cover material, any other observations that might be relevant shall also be recorded by the soil scientist. For example, particle size and consistency may differ in brown shale on a dump built in the 1950s versus brown shale on a dump built in the 1990s. Such observations may help determine how fast the cover material is weathering. In addition to the soil and vegetative cover, the survey team will also note and map any areas present that may be used as "salt licks" or areas and features that may otherwise result in additional soil consumption by wildlife.

<u>Activity 3 - Survey Vegetation Cover at Source and Background Areas</u>
During the vegetation survey, the relative abundance of species for all life forms (i.e., grasses, forbs and shrubs) will be noted. At this time, data will not be collected to determine the biomass of specific vegetation species. The relative abundance of the overall vegetative cover at each source and background area, as well as the relative abundance of each species encountered will be classified. The relative abundance classification system is as follows:

- dominant – 50 to 100% of area
- abundant – 25 to 50%
- common – 10 to 25%
- uncommon – 5 to 10%
- rare – 0 to 5%

Vegetation will be identified to species, if possible; if not, to the lowest taxonomic level possible. For ease of identification, this activity needs to commence in the spring or early summer prior to the planned sampling program. Each vegetation species will be further classified as to selenium uptake potential using the three-category system described in Table 4-1.

Table 4-1: Selenium Accumulator Plants (National Research Council, 1983)

Group 1—Primary Selenium Accumulators. Those plants that normally accumulate Se at very high levels, often several thousand mg/kg dw, including species of:		
Family	Genus	Common Names
Compositae	*Haplopappus*	bristleweed, goldenweed
	Machaeranthera	aster
Cruciferae	*Stanleya*	stanleya, princesplume
Leguminosae	*Astragalus*	locoweed, milk-vetch, poison-vetch, rattle-pod
Group 2—Secondary Selenium Absorbers. Those plants that rarely concentrate selenium to more than a few hundred mg/kg dw, including species of:		
Family	Genus	Common Names
Chenopodiaceae	*Atriplex*	orache, greasewood, shadscale, saltbush, silverscale
Compositae	*Aster*	aster, michaelmas-daisy
	Grindelia	gumweed, gumplant, resinweed, grindelia
	Gutierrezia	matchbrush, matchweed, snakeweed
	Machaeranthera	aster
Loasaceae	*Mentzelia*	blazing-star, metzelia
Scrophulariaceae	*Castilleja*	
Group 3—Normal Plants. Those plants not in either of the above two groups.		

It should be noted that the above classification system describes selenium uptake potential, not actual uptake. At least some of the accumulator Group 1 species grow only on seleniferous soil. In the Southeast Idaho Phosphate Resource Area, normal Group 3 species have been found to contain selenium at concentrations over 100 mg/kg dw when growing in affected soils. While the nature and extent of COPC concentrations will be evaluated by sampling, this information may identify the need for some follow-up assessments or interim actions (e.g., an eradication program).

The vegetation survey of each source and background area will be conducted simultaneously with the material cover and soil survey, so a two-man team is needed with one person being a soil scientist or geologist and the other being a range scientist, or botanist. The level of resolution of the survey is the entire source or background area. The team will spend sufficient time observing each area in order to thoroughly characterize it as to species present and associated relative abundances. The following survey methods will be employed to help ensure each area is adequately characterized:

- Each dump will be divided into quadrants for pedestrian survey
- The perimeter of each quadrant will be walked in its entirety, and additional transects traversing the quadrants will be walked to adequately characterize existing cover
- A map of existing cover by life-form will be developed from this survey
- In addition, a list of vegetation by species will be recorded, along with their corresponding relative abundance and selenium uptake potential for each dump site.

4.2 Sample Collection Activities

Activity 4 – Culturally Significant Plant Characterization in Source and Background Areas
A general protocol for collection of culturally significant plant samples, Activity 4, is presented in Section 5.0. Modification of this protocol is dependent upon the unique characteristics of any plants identified during the survey.

Activity 5 - Cover Material Quality Characterization in Source and Background Areas and
Activity 6 – Vegetation Quality Characterization in Source and Background Areas
Specific details for sample collection Activities 5 and 6 are presented Section 5.0. The general approach for both cover material and vegetation quality characterizations is the identification of ten randomly selected 50-ft x 50-ft square quadrats from each of the designated potential source areas. Drawings 1, 2, and 3 show the quadrat locations for each area. Within each quadrat, five randomly selected 1-ft^2 points will be sampled. These five samples will be composited to form the quadrat sample.

During the early summer sampling, at ten sites per mine, vegetation from source areas will be separated as to life form (grasses, forbs, and woody species). Mines will be stratified as follows:

- Ballard Mine – one sample will be randomly selected from each of the following nine potential source areas: 6 waste rock dumps, 2 partially backfilled pits, and 1 historic ore haul road. The tenth sample will be randomly selected from a pool of the remaining sites in the nine areas.

- Henry Mine – one sample will be randomly selected from each of the six potential source areas (5 waste rock dumps, 1 historic ore haul road) and four samples will be randomly selected from a pool of the remaining sites in all six potential source areas

- Enoch Valley Mine – three samples will be randomly selected from each of the three waste rock dumps (with MWD091 split into two areas) and the tenth sample will be randomly selected from a pool of the remaining sites in all three areas

At ten background sites, vegetation will also be separated as to life form (grasses, forbs, and woody species). Three quadrats will be randomly selected from each of the three background areas and the tenth quadrat will be randomly selected from a pool of the remaining background sites.

Sampling for life forms will be restricted to the quadrats. For example, if woody vegetation is not present in a selected quadrat, then it will be noted as not present. Additional quadrats or areas outside of quadrats will not be sampled for individual life forms.

In the fall sampling event, the 40 quadrats sampled for life forms in the early summer will be re-sampled for forbs only. Grid locations within the quadrat will be reselected.

In the event that vegetated areas are identified in either the open mine pits or the Ballard Mine shop areas, it is expected that the area available for sampling will be relatively small. Therefore, five judgmental grab samples will be collected. These samples will be selected to be representative of the relative abundance of plant species and soil variability in the area. If the area is sufficiently large, then five 2,500 sq. ft. quadrats will be used to collect composite samples. The quadrats will still be located on a judgmental basis. These samples will be considered reconnaissance level in these relatively small areas (less than 10 acres).

The sampling on the active haul road berm and in the tipple perimeter area at the Enoch Valley Mine will also use this approach. Judgmentally-located quadrats will be used along the Enoch Valley haul road. For these quadrats, there will be an attempt to distribute the location evenly along the road while also representing the diversity of berm material and plant species present. If the initial survey indicates a higher than expected distribution of soils and plants, then additional samples may be collected. Similar to the inactive haul road to be sampled at the Ballard and Henry Mines, the quadrat dimensions will be modified to the shape of the haul road berm, but will be approximately 2,500 sq. ft. in size.

While this data will not be directly comparable to the other source and background data, it will provide an estimation of the mean concentration and variability in the area evaluated. In all cases, shrub samples will be collected and composited separately from grass and forb samples.

4.3 Location, Frequency, and Schedule

Table 4-2 summarizes the location, frequency, and schedule for each activity. Also included on Table 4-2, the randomly selected quadrats for life form (LF) sampling during the early summer event and forb-only (FB) sampling during the fall event are identified. Vegetation sampling will be conducted in both early summer, between 15 June and 15 July, and early fall between 17 August and

15 September. Soil samples will be collected during the early summer event only. The soil samples will be co-located with the vegetation samples.

Vegetation sampling in the early summer will be conducted at each of the randomly selected quadrats in the potential source areas and background areas. Vegetation will be collected by life form in the 40 quadrats, 30 in potential source areas and 10 in background areas, selected as described in Section 4.2 above. In the fall, vegetation sampling of only forbs will conducted at the same 40 quadrats sampled for life forms in the early summer. No other quadrats will be sampled in the fall. Five new, randomly selected 1-ft^2 sample points within the previously sampled quadrats will be used for the fall sampling. If any of the five sample points is the same or adjacent to a sample point from the early summer event, it will be discarded and an alternate randomly selected. To facilitate relocating the quadrat for the fall sampling, the four corners will be staked and the location recorded using a handheld GPS.

The methodology for selection of sampling quadrats for each potential source area and background area is given below.

- an x-y coordinate system was superimposed over a map of each area ranging in values from 0 to 1

- two strings of random numbers were generated using Excel's RAND() function

- once random strings were generated they were saved so as to avoid any inadvertent change (e.g., Excel's RAND() function generates a new value every time any cell calculation is performed and ENTER is hit); this rule avoids any potential for bias by allowing random strings to change until a desired number might surface

- using the first value from both strings, the two random numbers formed a random coordinate with x coming from the first string and y coming from the second; using the first values avoids potential bias that could arise by subjectively selecting an order in the string to start

- the random coordinate was plotted on the map by locating the point 100x% and 100y% along the x and y axes, respectively; if the location fell outside the boundaries of the dump or outcrop, or if the point fell in a pond, the coordinate was discarded

- once the first coordinate was used or discarded, the second values from both strings were used to form a second coordinate, which was plotted or discarded, as appropriate; this process proceeded until ten locations were plotted on the map; if the number of coordinates discarded resulted in the strings being used up, another two sets of random number strings were generated

- if, after 5 to 7 stations were plotted, there was noticeable "clumping" occurring (i.e., stations randomly ending up being clustered in one section of the dump), a smaller sub-x-y coordinate system was inlayed into the portion of the area with no stations and the random sampling station selection process was repeated for the remaining stations. This step was added to avoid clumping while still maintaining necessary randomness

- after the ten random locations were plotted on the map, the map coordinates of each location was determined and tabulated

Selection of the 1-ft^2 grid points within each quadrat, where the soil and vegetation sample will be collected, is as follows:

- The field team locates the mapped quadrat using the provided GPS coordinates. A member of the team will face magnetic N and gently toss (not throw) a wooden stake over their shoulder. The stake is driven where the pointed end lands, forming the NW corner of the 50-ft x 50-ft square sampling quadrat. This procedure eliminates any potential for biasing the specific location of the stake.

- Once the NW corner of the quadrat is sited, a measuring tape and compass are used to form the 50 x 50 ft square quadrat. The quadrat is rotated such that the sides of the square are oriented N-S and W-E (based on magnetic N).

- Each quadrat is divided into 2,500 1-ft^2 sample points. Five sample points are randomly selected in the field using the RAND() function in Excel to generate strings of grid coordinates ranging from 0 to 49. Long strings of random numbers may be generated for use in the field prior to the sampling event. If so, a different pair of strings will be provided to each field team, and each team will use the random numbers sequentially in the order provided to avoid inadvertent reuse.

- A sample is collected from each of the five sample points and composited to represent the quadrat, as described in Section 5.0.

Table 4-2: Activity Locations, Frequency, and Schedule
(1 of 4)

Mine	Facility Type	Station ID	Latitude	Longitude	Survey	Sampling	
					June 2009	June/July 2009	Aug/Sept 2009
					Soil and Veg	Soil and Veg	Forbs Only
Ballard	Waste Rock Dump	MWD080-S1	42 50 06.11447	111 29 40.84768	x	x	
Ballard	Waste Rock Dump	MWD080-S2	42 50 07.16566	111 29 35.95953	x	LF	FB
Ballard	Waste Rock Dump	MWD080-S3	42 50 07.04146	111 29 34.51228	x	x	
Ballard	Waste Rock Dump	MWD080-S4	42 49 59.10204	111 29 42.85053	x	x	
Ballard	Waste Rock Dump	MWD080-S5	42 49 57.04395	111 29 38.75572	x	x	
Ballard	Waste Rock Dump	MWD080-S6	42 49 55.97856	111 29 42.29750	x	LF	FB
Ballard	Waste Rock Dump	MWD080-S7	42 49 50.26911	111 29 34.50839	x	x	
Ballard	Waste Rock Dump	MWD080-S8	42 49 42.22829	111 29 30.68255	x	x	
Ballard	Waste Rock Dump	MWD080-S9	42 49 41.45942	111 29 29.78265	x	x	
Ballard	Waste Rock Dump	MWD080-S10	42 49 37.16532	111 29 34.29496	x	x	
Ballard	Waste Rock Dump	MWD081-S1	42 49 35.77454	111 29 27.58579	x	x	
Ballard	Waste Rock Dump	MWD081-S2	42 49 34.64211	111 29 23.09525	x	x	
Ballard	Waste Rock Dump	MWD081-S3	42 49 29.74994	111 29 24.22280	x	x	
Ballard	Waste Rock Dump	MWD081-S4	42 49 26.65971	111 29 31.83679	x	LF	FB
Ballard	Waste Rock Dump	MWD081-S5	42 49 23.61004	111 29 25.79468	x	x	
Ballard	Waste Rock Dump	MWD081-S6	42 49 25.03525	111 29 17.57657	x	x	
Ballard	Waste Rock Dump	MWD081-S7	42 49 21.87582	111 29 21.41097	x	x	
Ballard	Waste Rock Dump	MWD081-S8	42 49 20.90462	111 29 19.15316	x	x	
Ballard	Waste Rock Dump	MWD081-S9	42 49 17.27417	111 29 08.82585	x	x	
Ballard	Waste Rock Dump	MWD081-S10	42 49 18.74069	111 29 06.95571	x	x	
Ballard	Waste Rock Dump	MWD082-S1	42 49 52.42947	111 28 33.13227	x	LF	FB
Ballard	Waste Rock Dump	MWD082-S2	42 49 45.97002	111 28 30.17980	x	x	
Ballard	Waste Rock Dump	MWD082-S3	42 49 43.87258	111 28 30.90364	x	x	
Ballard	Waste Rock Dump	MWD082-S4	42 49 41.40007	111 28 35.99630	x	x	
Ballard	Waste Rock Dump	MWD082-S5	42 49 28.81344	111 28 28.58843	x	x	
Ballard	Waste Rock Dump	MWD082-S6	42 49 16.53338	111 28 27.67104	x	x	
Ballard	Waste Rock Dump	MWD082-S7	42 49 32.41339	111 28 16.51981	x	x	
Ballard	Waste Rock Dump	MWD082-S8	42 49 29.18901	111 28 09.46019	x	x	
Ballard	Waste Rock Dump	MWD082-S9	42 49 23.39328	111 28 12.06552	x	x	
Ballard	Waste Rock Dump	MWD082-S10	42 49 19.65122	111 28 07.10998	x	x	
Ballard	Waste Rock Dump	MWD083-S1	42 49 32.81589	111 29 03.20790	x	LF	FB
Ballard	Waste Rock Dump	MWD083-S2	42 49 32.83121	111 29 00.35093	x	x	
Ballard	Waste Rock Dump	MWD083-S3	42 49 30.63976	111 28 58.49488	x	x	
Ballard	Waste Rock Dump	MWD083-S4	42 49 29.71995	111 28 56.57840	x	x	
Ballard	Waste Rock Dump	MWD083-S5	42 49 28.08515	111 28 58.65341	x	x	
Ballard	Waste Rock Dump	MWD083-S6	42 49 26.41796	111 28 59.61833	x	x	
Ballard	Waste Rock Dump	MWD083-S7	42 49 25.68542	111 28 57.17487	x	x	
Ballard	Waste Rock Dump	MWD083-S8	42 49 24.52422	111 28 55.64071	x	x	
Ballard	Waste Rock Dump	MWD083-S9	42 49 22.75318	111 28 57.44223	x	x	
Ballard	Waste Rock Dump	MWD083-S10	42 49 18.18627	111 29 01.75255	x	x	
Ballard	Waste Rock Dump	MWD084-S1	42 50 18.03296	111 28 43.52943	x	x	
Ballard	Waste Rock Dump	MWD084-S2	42 50 16.27770	111 28 42.32400	x	x	
Ballard	Waste Rock Dump	MWD084-S3	42 50 18.01683	111 28 38.61169	x	x	
Ballard	Waste Rock Dump	MWD084-S4	42 50 15.60945	111 28 38.52875	x	x	
Ballard	Waste Rock Dump	MWD084-S5	42 50 12.68070	111 28 34.48447	x	LF	FB
Ballard	Waste Rock Dump	MWD084-S6	42 50 05.86661	111 28 30.47709	x	x	
Ballard	Waste Rock Dump	MWD084-S7	42 50 06.07770	111 28 28.93010	x	x	
Ballard	Waste Rock Dump	MWD084-S8	42 50 05.42418	111 28 27.41580	x	x	
Ballard	Waste Rock Dump	MWD084-S9	42 50 08.62911	111 28 27.42613	x	x	
Ballard	Waste Rock Dump	MWD084-S10	42 50 08.73958	111 28 26.06467	x	x	
Ballard	Waste Rock Dump	MWD093-S1	42 49 47.60504	111 29 22.67241	x	x	
Ballard	Waste Rock Dump	MWD093-S2	42 49 50.78728	111 29 12.93973	x	LF	FB
Ballard	Waste Rock Dump	MWD093-S3	42 49 49.05736	111 29 08.48029	x	x	
Ballard	Waste Rock Dump	MWD093-S4	42 49 50.74493	111 29 05.81605	x	x	
Ballard	Waste Rock Dump	MWD093-S5	42 49 49.73462	111 29 03.73566	x	x	
Ballard	Waste Rock Dump	MWD093-S6	42 49 41.96764	111 29 18.66401	x	x	
Ballard	Waste Rock Dump	MWD093-S7	42 49 44.58904	111 29 10.40160	x	x	
Ballard	Waste Rock Dump	MWD093-S8	42 49 46.52484	111 29 03.35835	x	x	
Ballard	Waste Rock Dump	MWD093-S9	42 49 40.09811	111 29 15.24435	x	x	
Ballard	Waste Rock Dump	MWD093-S10	42 49 37.37218	111 29 02.65850	x	x	
Ballard	Partially Backfilled Pit	MMP035-S1	42 50 00.16000	111 29 22.27000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S2	42 49 59.84000	111 29 17.62000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S3	42 49 57.87000	111 29 26.42000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S4	42 49 56.59000	111 29 22.87000	x	x	

Table 4-2: Activity Locations, Frequency, and Schedule
(2 of 4)

Mine	Facility Type	Station ID	Latitude	Longitude	Survey	Sampling	
					June 2009	June/July 2009	Aug/Sept 2009
					Soil and Veg	Soil and Veg	Forbs Only
Ballard	Partially Backfilled Pit	MMP035-S5	42 49 55.68000	111 29 27.85000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S6	42 49 53.20000	111 29 27.16000	x	LF	FB
Ballard	Partially Backfilled Pit	MMP035-S7	42 49 53.44000	111 29 22.71000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S8	42 49 52.56000	111 29 24.11000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S9	42 49 50.12000	111 29 27.61000	x	x	
Ballard	Partially Backfilled Pit	MMP035-S10	42 49 46.06000	111 29 28.58000	x	x	
Ballard	Partially Backfilled Pit	MMP036-S1	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S2	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S3	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S4	TBD	TBD	x	LF	FB
Ballard	Partially Backfilled Pit	MMP036-S5	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S6	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S7	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S8	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S9	TBD	TBD	x	x	
Ballard	Partially Backfilled Pit	MMP036-S10	TBD	TBD	x	x	
Ballard	Historic Ore Haul Road	MHR001-S1	42 49 05.81405	111 29 33.76891	x	x	
Ballard	Historic Ore Haul Road	MHR001-S2	42 49 05.71083	111 29 31.09014	x	x	
Ballard	Historic Ore Haul Road	MHR001-S3	42 49 18.78084	111 28 53.95064	x	x	
Ballard	Historic Ore Haul Road	MHR001-S4	42 49 14.64184	111 28 49.97982	x	LF	FB
Ballard	Historic Ore Haul Road	MHR001-S5	42 49 15.64387	111 28 47.60476	x	x	
Ballard	Historic Ore Haul Road	MHR001-S6	42 49 30.82881	111 28 23.66713	x	x	
Ballard	Historic Ore Haul Road	MHR001-S7	42 49 40.53539	111 28 24.71187	x	x	
Ballard	Historic Ore Haul Road	MHR001-S8	42 49 49.80655	111 28 20.09803	x	x	
Ballard	Historic Ore Haul Road	MHR001-S9	42 49 51.76406	111 28 19.88005	x	x	
Ballard	Historic Ore Haul Road	MHR001-S10	42 50 03.31709	111 28 23.26094	x	x	
Ballard	Historic Facility	MBS001-S1	TBD	TBD	x	x	
Ballard	Historic Facility	MBS001-S2	TBD	TBD	x	x	
Ballard	Historic Facility	MBS001-S3	TBD	TBD	x	x	
Ballard	Historic Facility	MBS001-S4	TBD	TBD	x	x	
Ballard	Historic Facility	MBS001-S5	TBD	TBD	x	x	
Ballard	Mine Specific Background	MBB001-S1	42 50 44.02707	111 28 57.97198	x	LF	FB
Ballard	Mine Specific Background	MBB001-S2	42 50 40.97870	111 29 01.39478	x	x	
Ballard	Mine Specific Background	MBB001-S3	42 50 40.11929	111 29 03.47888	x	x	
Ballard	Mine Specific Background	MBB001-S4	42 50 39.85896	111 29 00.02897	x	x	
Ballard	Mine Specific Background	MBB001-S5	42 50 36.23992	111 28 52.90612	x	LF	FB
Ballard	Mine Specific Background	MBB001-S6	42 50 33.95050	111 28 56.87248	x	x	
Ballard	Mine Specific Background	MBB001-S7	42 50 32.30813	111 28 52.53273	x	x	
Ballard	Mine Specific Background	MBB001-S8	42 50 32.34912	111 28 50.06913	x	LF	FB
Ballard	Mine Specific Background	MBB001-S9	42 50 31.27812	111 28 48.07258	x	x	
Ballard	Mine Specific Background	MBB001-S10	42 50 28.10856	111 28 53.98122	x	LF	FB
Henry	Waste Rock Dump	MWD085-S1	42 54 31.37065	111 30 42.43117	x	x	
Henry	Waste Rock Dump	MWD085-S2	42 54 27.66365	111 30 42.86450	x	LF	FB
Henry	Waste Rock Dump	MWD085-S3	42 54 34.68459	111 30 36.55839	x	LF	FB
Henry	Waste Rock Dump	MWD085-S4	42 54 29.01044	111 30 31.59389	x	x	
Henry	Waste Rock Dump	MWD085-S5	42 54 32.42183	111 30 30.10435	x	x	
Henry	Waste Rock Dump	MWD085-S6	42 54 32.65644	111 30 26.86651	x	x	
Henry	Waste Rock Dump	MWD085-S7	42 54 32.88591	111 30 22.72599	x	x	
Henry	Waste Rock Dump	MWD085-S8	42 54 31.29088	111 30 25.40319	x	x	
Henry	Waste Rock Dump	MWD085-S9	42 54 24.53965	111 30 28.23379	x	x	
Henry	Waste Rock Dump	MWD085-S10	42 54 22.54414	111 30 24.21567	x	x	
Henry	Waste Rock Dump	MWD086-S1	42 53 07.34843	111 28 50.07217	x	x	
Henry	Waste Rock Dump	MWD086-S2	42 52 09.15505	111 27 44.41019	x	x	
Henry	Waste Rock Dump	MWD086-S3	42 52 17.46108	111 27 31.45739	x	x	
Henry	Waste Rock Dump	MWD086-S4	42 52 22.03954	111 28 02.44835	x	x	
Henry	Waste Rock Dump	MWD086-S5	42 52 31.89969	111 27 57.14661	x	x	
Henry	Waste Rock Dump	MWD086-S6	42 52 39.59697	111 28 01.44436	x	x	
Henry	Waste Rock Dump	MWD086-S7	42 52 50.14271	111 28 15.39614	x	LF	FB
Henry	Waste Rock Dump	MWD086-S8	42 53 02.19688	111 28 30.24360	x	x	
Henry	Waste Rock Dump	MWD086-S9	42 53 05.83239	111 28 29.40410	x	x	
Henry	Waste Rock Dump	MWD086-S10	42 53 18.87424	111 28 56.22859	x	x	
Henry	Waste Rock Dump	MWD087-S1	42 52 52.52917	111 28 46.09719	x	x	
Henry	Waste Rock Dump	MWD087-S2	42 52 45.61071	111 28 39.89007	x	x	
Henry	Waste Rock Dump	MWD087-S3	42 52 42.33005	111 28 43.92203	x	x	

Table 4-2: Activity Locations, Frequency, and Schedule
(3 of 4)

Mine	Facility Type	Station ID	Latitude	Longitude	Survey	Sampling	
					June 2009	June/July 2009	Aug/Sept 2009
					Soil and Veg	Soil and Veg	Forbs Only
Henry	Waste Rock Dump	MWD087-S4	42 52 39.80227	111 28 29.98730	x	x	
Henry	Waste Rock Dump	MWD087-S5	42 52 38.15120	111 28 28.08097	x	x	
Henry	Waste Rock Dump	MWD087-S6	42 52 32.96601	111 28 19.95009	x	LF	FB
Henry	Waste Rock Dump	MWD087-S7	42 52 30.36090	111 28 24.76569	x	x	
Henry	Waste Rock Dump	MWD087-S8	42 52 26.61314	111 28 18.65895	x	x	
Henry	Waste Rock Dump	MWD087-S9	42 52 24.37768	111 28 28.26792	x	x	
Henry	Waste Rock Dump	MWD087-S10	42 52 21.09879	111 28 30.32764	x	x	
Henry	Waste Rock Dump	MWD088-S1	42 53 44.97729	111 29 09.11243	x	x	
Henry	Waste Rock Dump	MWD088-S2	42 53 46.00991	111 29 05.47088	x	LF	FB
Henry	Waste Rock Dump	MWD088-S3	42 53 44.16742	111 28 54.84512	x	x	
Henry	Waste Rock Dump	MWD088-S4	42 53 43.86023	111 29 13.06421	x	x	
Henry	Waste Rock Dump	MWD088-S5	42 53 37.08226	111 29 10.17213	x	x	
Henry	Waste Rock Dump	MWD088-S6	42 53 37.74884	111 28 54.20524	x	x	
Henry	Waste Rock Dump	MWD088-S7	42 53 33.05044	111 29 05.57800	x	x	
Henry	Waste Rock Dump	MWD088-S8	42 53 41.99852	111 29 21.03631	x	x	
Henry	Waste Rock Dump	MWD088-S9	42 53 28.14623	111 29 04.49854	x	LF	FB
Henry	Waste Rock Dump	MWD088-S10	42 53 26.65381	111 28 54.36702	x	x	
Henry	Waste Rock Dump	MWD090-S1	42 52 01.68366	111 27 37.11362	x	x	
Henry	Waste Rock Dump	MWD090-S2	42 52 01.02343	111 27 24.67037	x	LF	FB
Henry	Waste Rock Dump	MWD090-S3	42 51 54.86262	111 27 21.16020	x	x	
Henry	Waste Rock Dump	MWD090-S4	42 51 53.53644	111 27 26.86993	x	LF	FB
Henry	Waste Rock Dump	MWD090-S5	42 51 54.67380	111 27 10.99496	x	x	
Henry	Waste Rock Dump	MWD090-S6	42 51 55.92827	111 27 10.35068	x	x	
Henry	Waste Rock Dump	MWD090-S7	42 51 56.13099	111 27 06.83386	x	x	
Henry	Waste Rock Dump	MWD090-S8	42 51 47.69582	111 27 05.37966	x	x	
Henry	Waste Rock Dump	MWD090-S9	42 51 44.95344	111 27 00.52417	x	x	
Henry	Waste Rock Dump	MWD090-S10	42 51 43.28702	111 26 56.51834	x	x	
Henry	Historic Ore Haul Road	MHR002-S1	42 52 14.95328	111 27 47.03442	x	x	
Henry	Historic Ore Haul Road	MHR002-S2	42 52 17.46217	111 27 49.53498	x	x	
Henry	Historic Ore Haul Road	MHR002-S3	42 52 23.99941	111 27 53.41516	x	x	
Henry	Historic Ore Haul Road	MHR002-S4	42 52 38.35270	111 28 07.04355	x	LF	FB
Henry	Historic Ore Haul Road	MHR002-S5	42 52 39.68371	111 28 08.73158	x	x	
Henry	Historic Ore Haul Road	MHR002-S6	42 52 54.78385	111 28 25.24955	x	x	
Henry	Historic Ore Haul Road	MHR002-S7	42 53 15.53544	111 28 45.47013	x	x	
Henry	Historic Ore Haul Road	MHR002-S8	42 53 53.75120	111 29 18.82495	x	x	
Henry	Historic Ore Haul Road	MHR002-S9	42 53 57.06477	111 29 21.75125	x	x	
Henry	Historic Ore Haul Road	MHR002-S10	42 54 04.93983	111 29 33.40403	x	LF	FB
Henry	Mine Specific Background	MBH001-S1	42 54 24.73208	111 30 03.01912	x	x	
Henry	Mine Specific Background	MBH001-S2	42 54 22.84273	111 29 59.61659	x	x	
Henry	Mine Specific Background	MBH001-S3	42 54 23.25314	111 29 57.23342	x	x	
Henry	Mine Specific Background	MBH001-S4	42 54 22.54578	111 29 55.25515	x	x	
Henry	Mine Specific Background	MBH001-S5	42 54 20.96176	111 29 56.90678	x	LF	FB
Henry	Mine Specific Background	MBH001-S6	42 54 18.94814	111 30 01.87789	x	x	
Henry	Mine Specific Background	MBH001-S7	42 54 16.83959	111 29 59.27262	x	x	
Henry	Mine Specific Background	MBH001-S8	42 54 19.56938	111 29 52.93480	x	LF	FB
Henry	Mine Specific Background	MBH001-S9	42 54 19.67204	111 29 48.28397	x	x	
Henry	Mine Specific Background	MBH001-S10	42 54 12.20750	111 29 46.79054	x	LF	FB
Henry	Mine Specific Background	MBH002-S1	42 53 28.28750	111 28 43.47088	x	x	
Henry	Mine Specific Background	MBH002-S2	42 53 26.55850	111 28 45.74218	x	x	
Henry	Mine Specific Background	MBH002-S3	42 53 25.51611	111 28 45.54495	x	x	
Henry	Mine Specific Background	MBH002-S4	42 53 26.99800	111 28 42.27715	x	x	
Henry	Mine Specific Background	MBH002-S5	42 53 22.63119	111 28 44.26169	x	LF	FB
Henry	Mine Specific Background	MBH002-S6	42 53 22.27368	111 28 43.13218	x	x	
Henry	Mine Specific Background	MBH002-S7	42 53 16.50034	111 28 34.64575	x	x	
Henry	Mine Specific Background	MBH002-S8	42 53 16.97799	111 28 33.16485	x	LF	FB
Henry	Mine Specific Background	MBH002-S9	42 53 14.03382	111 28 31.38164	x	x	
Henry	Mine Specific Background	MBH002-S10	42 53 13.58424	111 28 28.30313	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD091N-S1	42 53 47.00000	111 25 52.34000	x	x	
Enoch Valley	Waste Rock Dump	MWD091N-S2	42 53 45.45000	111 25 53.98000	x	x	
Enoch Valley	Waste Rock Dump	MWD091N-S3	42 53 42.02000	111 25 39.79000	x	x	
Enoch Valley	Waste Rock Dump	MWD091N-S4	42 53 39.21000	111 25 45.17000	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD091N-S5	42 53 36.19000	111 25 17.40000	x	x	
Enoch Valley	Waste Rock Dump	MWD091N-S6	42 53 34.48000	111 25 29.13000	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD091N-S7	42 53 31.63000	111 25 43.54000	x	LF	FB

Table 4-2: Activity Locations, Frequency, and Schedule
(4 of 4)

Mine	Facility Type	Station ID	Latitude	Longitude	Survey	Sampling	
					June 2009	June/July 2009	Aug/Sept 2009
					Soil and Veg	Soil and Veg	Forbs Only
Enoch Valley	Waste Rock Dump	MWD091N-S8	42 53 30.28000	111 25 36.49000	x	x	
Enoch Valley	Waste Rock Dump	MWD091N-S9	42 53 30.72000	111 25 21.36000	x	x	
Enoch Valley	Waste Rock Dump	MWD091N-S10	42 53 31.72000	111 25 13.69000	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD091S-S1	42 53 07.96000	111 24 45.04000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S2	42 53 00.91000	111 24 38.99000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S3	42 52 59.54000	111 24 30.69000	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD091S-S4	42 52 55.63000	111 24 28.05000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S5	42 52 49.93000	111 24 26.50000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S6	42 52 41.24000	111 24 15.17000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S7	42 52 39.55000	111 24 09.29000	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD091S-S8	42 52 33.25000	111 24 10.83000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S9	42 52 30.44000	111 24 01.84000	x	x	
Enoch Valley	Waste Rock Dump	MWD091S-S10	42 52 21.13000	111 23 49.65000	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD092-S1	42 52 48.45232	111 24 29.08072	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S2	42 52 21.23499	111 24 22.73554	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S3	42 52 22.44965	111 24 18.09202	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S4	42 52 23.48066	111 24 09.80691	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD092-S5	42 52 16.27271	111 24 02.02898	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S6	42 52 12.04439	111 23 51.12751	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S7	42 52 09.07395	111 23 42.51146	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S8	42 52 08.31721	111 23 37.63154	x	x	
Enoch Valley	Waste Rock Dump	MWD092-S9	42 51 54.74284	111 23 41.78991	x	LF	FB
Enoch Valley	Waste Rock Dump	MWD092-S10	42 51 53.98241	111 23 42.15427	x	LF	FB
Enoch Valley	Active Facility	MAR001-S1	TBD	TBD	x	x	
Enoch Valley	Active Facility	MAR001-S2	TBD	TBD	x	x	
Enoch Valley	Active Facility	MAR001-S3	TBD	TBD	x	x	
Enoch Valley	Active Facility	MAR001-S4	TBD	TBD	x	x	
Enoch Valley	Active Facility	MAR001-S5	TBD	TBD	x	x	
Enoch Valley	Active Facility	MTA001-S1	TBD	TBD	x	x	
Enoch Valley	Active Facility	MTA001-S2	TBD	TBD	x	x	
Enoch Valley	Active Facility	MTA001-S3	TBD	TBD	x	x	
Enoch Valley	Active Facility	MTA001-S4	TBD	TBD	x	x	
Enoch Valley	Active Facility	MTA001-S5	TBD	TBD	x	x	
Enoch Valley	Mine Specific Background	MBE001-S1	42 53 23.55852	111 25 35.54650	x	LF	FB
Enoch Valley	Mine Specific Background	MBE001-S2	42 53 24.95652	111 25 29.00127	x	x	
Enoch Valley	Mine Specific Background	MBE001-S3	42 53 22.95036	111 25 30.51928	x	x	
Enoch Valley	Mine Specific Background	MBE001-S4	42 53 20.68993	111 25 20.16568	x	x	
Enoch Valley	Mine Specific Background	MBE001-S5	42 53 23.05578	111 25 25.92617	x	x	
Enoch Valley	Mine Specific Background	MBE001-S6	42 53 20.65515	111 25 24.33178	x	x	
Enoch Valley	Mine Specific Background	MBE001-S7	42 53 15.94054	111 25 18.46910	x	LF	FB
Enoch Valley	Mine Specific Background	MBE001-S8	42 53 12.83071	111 25 07.94820	x	x	
Enoch Valley	Mine Specific Background	MBE001-S9	42 53 14.86522	111 25 14.29445	x	LF	FB
Enoch Valley	Mine Specific Background	MBE001-S10	42 53 17.48680	111 25 22.02035	x	x	

Notes:
Coordinates are in geographic lat/long using NAD27
MBH001 represents the primary background area at Henry Mine, whereas MBH002 is the secondary background area. Only one of these areas will be sampled.
FB - Forbs = Vegetation samples will be assigned the designation (-FB) for forbs.
LF - Life Form = Vegetation samples will be separated as to life form. Samples will be assigned one of 5 separate designations depending on the vegetation type collected. They are as follows: (-GS) for grasses, (-FB) for forbs, (-SF) for shrub fruit, (-SL) for shrub leaves, and (-SM) for shrub stems
TBD - To Be Determined
x - Vegetation samples will be separated and designated as follows: (-GF) for grasses and forbs combined, (-SF) for shrub fruit, (-SL) for shrub leaves, and (-SM) for shrub stems

5.0 SAMPLE COLLECTION AND ANALYSIS

This section presents the site access, equipment, and procedures for the collection, handling, and analysis of each sampled medium. Where applicable, references to SOPs are provided.

5.1 Site Access, Logistics, and Safety

P4 has access to all source areas and background areas. The A/T will be notified, at minimum, five business days prior to commencement of field activities. The MWH Field Team Leader will notify the P4 Project Manager (Barry Koch) at minimum three days prior to working at a mine area. Such notification is necessary to arrange for any company-specific safety training, and if necessary, to arrange for a company representative to accompany the crew to provide access through locked gates. Relevant company and agency contacts are presented in Table 6-1.

Field equipment and samples will be stored at the Fox Hills Ranch, owned by P4. Equipment, supplies, and samples will be shipped and received from the Monsanto plant, in Soda Springs, in care of Barry Koch, P4. Additional sample handling and shipping information is presented in Section 5.5.

Safety procedures for the site investigation are described in the HSP. Enoch Valley Mine has its own safety requirements that will be followed by field personnel when working in, or traveling through, active areas of the site. The mine-specific safety requirements involve a short training orientation for hazard recognition and avoidance. In the event that P4's corporate safety policy is stricter than the requirements of the HSP, those corporate safety requirements will take precedence.

5.2 Soil Sample Collection

Soil samples will be collected in each quadrat located in the source and background areas. Selection of quadrats is described in Section 4.3. Each quadrat location, shown in Drawings 1, 2, and 3 represents the NW corner of a square 50-ft x 50-ft sampling quadrat. The quadrat will be rotated such that the sides of the square are oriented N-S and W-E (based on magnetic N).

Soil samples will be collected from each of the five randomly selected 1-ft^2 sample points in accordance with SOP-NW-7.2, *Collection of Soil Samples*, located in Appendix B. All soil and vegetation samples will be co-located. That is, one soil sample will be collected within each 1-ft^2 grid point from which the vegetation sample was collected. The soil sample will be collected after the vegetation has been clipped (Section 5.3). The soil sampling depth is 0-6 inches. A soil coring device will be used to ensure a consistent volume of soil will be collected from each grid point.

Once the soil samples have been collected from each of the five sample points, they will be composited into one sample in a stainless steel bowl then sieved through a ¼-inch sieve. Large debris will be removed, shaken lightly to dislodge adhered particles, and then discarded. The material that passes through the sieve will be transferred to two (or more) 16-ounce glass sample containers. Field sieving will reduce the quantity of material such that the entire sample can be submitted to the laboratory rather than field-compositing, splitting, and storing the remaining soil on site. Sample containers, preservation techniques, sample volumes, and holding time requirements are summarized in Table 2-1 of the QAPP.

5.3 Vegetation Sample Collection

This section describes the protocol for sampling both upland vegetation and the culturally significant vegetation. For this effort "upland vegetation" is any plant not listed as culturally significant in Section 3.0. All plant samples (i.e., grasses, forbs, and shrubs) will be collected in accordance with SOP-NW-19.0, *Collection of Vegetation Samples*, located in Appendix B. When co-located with a soil sample, the vegetation samples will be collected immediately before the soil sample.

5.3.1 Upland Vegetation Sample Collection

Grasses and forbs within each of the five 1-ft^2 grid points will be clipped at the ground surface. The five samples will be composited directly into one 10-gallon paper bag. Shrubs within each of the five 1-ft^2 sample points will be clipped to remove current year's growth of leaves, stems and fruit. Each plant part will be composited separately into a no. 10 grocery bag for separate chemical analysis if needed. If more than one shrub species occurs in the sample locations, these species will be composited separately. Sample containers, preservation techniques, sample volumes, and holding time requirements are summarized in Table 2-1 of the QAPP.

If after the five samples have been collected and composited, the sample does not meet the minimum weight required by the laboratory for grass and forb analysis (200 grams), further co-located soil and grass/forb samples will be collected within the quadrat. The additional samples will be composited with the original composite of five soil and grass/forb samples, respectively, until the minimum sample weight for vegetation is achieved or until a maximum of ten total samples has been collected.

5.3.2 Culturally Significant Plants Sample Collection

Immediately following completion of the vegetation survey, a list of culturally significant plants observed will be submitted to the A/T. The following general protocol will be used to sample each culturally significant plant species that is present:

- Only edible plant parts will be collected
- Species with multiple edible plant parts (e.g., roots and shoots) will be sampled and analyzed separately
- All edible plant parts collected will be washed prior to sample analysis
- The number of plants sampled for each species will vary depending upon abundance. A maximum of three plants will be sampled per species and composited into one sample for analysis

This general protocol may be modified to account for unique characteristics of the plants such as maturation times of edible parts.

5.4 Sample Designation

Samples will be labeled with all necessary information on laboratory supplied labels using waterproof ink. Pre-printed labels will contain the following information:

- Site location
- Sample identification
- Method of preservation, if used
- Sample matrix

The date and time of sample collection and sampler's initials will be added to the label at time of collection.

Each sample will be assigned a unique identification number. This number will be coded according to sample location according to the following format:

AABB-MXXxxx-YYY-ZZ-c

where:

- **AA** indicates the year (two digits) the sampling event <u>started</u>

- **BB** indicates the month (two digits) the sampling event <u>started</u>

- **M** designates "M" for Monsanto and is used to differentiate from other sample stations identified by MWH for Idaho Mine Association (IMA) mine-specific investigations.

- **XX** denotes the station type, as follows:

AR:	Active Ore Haul Road
CS:	Culturally Significant plants
BB:	Ballard Mine Background
BH:	Henry Mine Background
BE:	Enoch Valley Mine Background
BS:	Ballard Mine Shop
HR:	Historic Ore Haul Road
<u>PB</u>	<u>Pit Backfill Area (Ballard)</u>
<u>PO</u>	<u>Pit Area (Other)</u>
TA:	Enoch Valley Mine Tipple Area
WD:	Waste Rock Dump

- **xxx** denotes the specific three-digit station number/location (ascending order starting at 001), for example:
  - WD080 is Ballard Mine Overburden Dump MWD080
  - <u>HR001 Ballard Haul Road, HR002 Henry Haul Road, HR003 Enoch Valley Haul Road</u>
  - BB001, BH001 or BH002, and BE001 are the waste rock dump background stations at Ballard, Henry, and Enoch Valley mines, respectively.

- **YYY** sample quadrat number; quadrats are sequentially numbered (with a leading zero) on each source or background area, for example:
  - MWD080-07 indicates a sample collected from quadrat seven on Ballard Mine Overburden Dump #1.

- **ZZ** denotes media type; media types are as follows:
  - SS: Surface Soil
  - GF: Grasses and Forbs
  - GS: Grasses
  - FB: Forbs
  - SF: Shrub Fruit
  - SL: Shrub Leaves
  - SM: Shrub Stems

- **c** denotes the replicate number 1, 2 or 3.

For example, sample number **0906-MWD080-07-SS-1** describes the first replicate of a surface soil sample, collected from quadrat seven on Monsanto (P4), Ballard Mine Overburden Dump #1 in June 2009.

For equipment rinsate samples, the number will be identified as **AABB – ER – ZZ – bb**

AA: Indicates the year (two digits) the sampling event started
BB: Indicates the month (two digits) the sampling event started
ER: Equipment Rinsate
ZZ: Media type (surface soil or vegetation)
bb: Rinsate number (01, 02, 03,…. etc.)

If multiple field teams are generating blanks on the same day, each team will be assigned unique numbers or a range of numbers prior to sampling.

5.5 Sample Handling and Shipping

Sample containers will be sealed in plastic bags with wire ties and immediately placed on ice in an insulated cooler to ≤ 6 °C. Insulated coolers will be provided by the contract laboratories or purchased locally. All samples will be stored in the coolers and handled as specified in Section 2.3.2 of the QAPP. All samples will remain in the coolers until the end of the day when all of the samples will be placed in a locked refrigerator at the Fox Hills Ranch.

Samples will be shipped to the laboratories with blue ice or bagged wet ice in coolers secured with packing tape, via overnight Federal Express service to the appropriate laboratory. If possible, only one type of medium will be shipped in each cooler. MWH will fill out appropriate chain-of-custody forms supplied by the respective laboratory. The chain-of-custody will be included with the sample shipment, and copies of all chains-of-custody along with Federal Express waybills will be kept by MWH field personnel.

All samples will be sent to Microbac at the following address:

Microbac
158 Starlite Drive
Marietta, OH 45750
(740) 373-4071
Attn: Kathy Albertson

Supplies including sample containers and coolers will be sent to the Monsanto Plant:

Monsanto Company
1853 HWY 34
Soda Springs, ID 83276
(208) 547-1439
Attention: Barry Koch

5.6 Sample Analysis

The COPCs listed in Table 5-1 will be analyzed as directed by the A/T Technical Memorandum *"Chemicals of Potential Concern to Sample for Soil and Vegetation at Ballard, Henry, and Enoch Valley Mines"* (IDEQ, 2008b) [attached to A/T comments on 26 June 2008 Memorandum (MWH 2008)]. The A/T developed the COPC list to ensure consistency with EPA guidance and to address problems with the screening process used in the past (e.g., the Area Wide Risk Assessment (AWRA) which initially screened COPCs based on a comparison to background).

Preparation and analysis of the soil and vegetation samples is discussed in Section 2.4 of the QAPP.

TABLE 5-1

ACHIEVABLE LABORATORY LIMITS AND APPLICABLE PROJECT SCREENING VALUES

(Page 1 of 2)

			Achievable Laboratory Limits [1]		Soil Screening Levels for Human Health and Ecological Receptors							
					ORNL Human Health Soil Screening Levels [2]		Eco-SSL [3]				ORNL Ecological Soil Screening Levels [4]	
Method	**Sampling Parameter**	**Units**	**RL**	**MDL**	**Residential**	**Industrial**	**Plants**	**Soil Invert.**	**Avian**	**Mam-malian**	**Avian**	**Mammalian**
EPA 6020A	Antimony	mg/kg	0.100	0.050	31 [a]	410 [a]	na	78	na	0	na	0.25
	Arsenic	mg/kg	0.300	0.075	0.39 [b]	1.6 [b]	18	na	43	46	2	0.25 [x]
	Cadmium	mg/kg	0.100	0.025	70 [c,d]	810 [c,d]	32	140	0.77	0.36	1.2	3.5
	Chromium, total:											
	Chromium III	mg/kg	0.400 [e]	0.100 [e]	120,000 [f]	1,500,000 [f]	na	na	26	34	0.83	10,000
	Chromium VI	mg/kg	0.400 [e]	0.100 [e]	39 [g]	200 [g]	na	na	na	130	na	12
	Cobalt	mg/kg	0.500	0.125	23	300	13	na	120	230	na	na
	Copper	mg/kg	0.600	0.150	3,100	41,000	70	80	28	49	38.9	55.7
	Manganese	mg/kg	0.200	0.050	1,800 [h]	23,000 [h]	220	450	4,300	4,000	825	322
	Nickel	mg/kg	0.800	0.200	1,600 [i]	20,000 [i]	38	280	210	130	64	147
	Selenium	mg/kg	0.200	0.100	390	5,100	0.52	4.1	1.2	0.63	0.33	0.73
	Silver	mg/kg	0.200	0.050	390	5,100	560	na	4.2	14	na	na
	Thallium	mg/kg	0.020	0.010	5 [i]	66 [i]	- -	- -	- -	- -	na	na
	Uranium	mg/kg	0.500	0.100	230 [i]	3100 [i]	- -	- -	- -	- -	21	6
EPA 6010B	Boron	mg/kg	25.000	10.000	16,000 [j]	200,000 [j]	- -	- -	- -	- -	24 [x]	103
	Molybdenum	mg/kg	3.000	1.500	390	5,100	- -	- -	- -	- -	2.9 [x]	0.5 [y]
	Vanadium	mg/kg	0.500	0.125	390 [c]	5,200 [c]	na	na	7.8	280	9.4	0.7
	Zinc	mg/kg	1.000	0.500	23,000 [a]	310,000 [a]	160	120	46	79	12	586
EPA 7470A	Mercury	mg/kg	0.250	0.010	7 [k]	28 [k]	- -	- -	- -	- -	0.4	4.7
EPA 7196A	Chromium VI	mg/kg	0.100	0.050	39	200	na	na	na	130	na	12

- - no screening level established

[1] Generally achievable laboratory reporting limits for soil samples; method detection limits may vary annually. Since the method will be performed on dried samples,

the basis for these RLs can be considered dry weight. Reporting limits for plant tissue samples will be deteremined by the method validation (see Appendix A).
[2] Oak Ridge National Laboratory (ORNL) screening levels for chemical contaminants; units are mg/kg, dry weight.
[3] EPA ecological soil screening levels (SSL); units are mg/kg, dry weight.
[4] Calculated from lowest reported no observed adverse effects level (NOAEL)-based benchmark for food from ORNL; units are mg/kg, dry weight.

[a] metallic
[b] inorganic
[c] and compounds
[d] in diets
[e] value is for total chromium
[f] insoluble salts. Although the correct screening level is listed, 1,500,000 mg/kg is not possible because there are 1,000,000 mg in a kg.
[g] particulates
[h] in water
[i] soluble salts
[j] and borates only
[k] elemental

[x] Screening value is less than the RL but greater than the MDL.
[y] Screening value is less than both the RL and MDL (laboratory does not analyze molybdenum by 6020A).

MDL - method detection limit
mg/kg - milligrams per kilogram
NA - not applicable
na - not available (insufficient data available to derive and Eco-SSL)
RL - reporting limit

5.7 Sampling Quality Assurance

Quality control requirements are discussed in Section 2.5 of the QAPP. One equipment rinsate blank sample will be collected at the end of each day of sampling per matrix per field team. Samples for equipment rinsate will be analyzed for all target analytes except Cr VI. Total chromium values will be used to evaluate impact of potential contamination for Cr VI.

True field duplicate sampling of the soil and vegetation is not possible, so, at a subset of sampling locations, primary samples will be collected in triplicate. Specifically, at 10 percent of sampling locations, three individual primary samples will be collected; all three samples are primary samples but are collected in triplicate.

The equipment rinsate blank and triplicate samples will be submitted to Microbac. Laboratory quality control samples, used to evaluate laboratory performance, are discussed in Section 2.5.2 of the QAPP.

6.0 PROJECT ORGANIZATION

6.1 Project Team

Figure 6-1 presents the organization of the project team. Contact information for each member of the project team is presented in Table 6-1. The field team leader will submit a daily update to P4 and MWH program managers that contains a report of daily progress, any variances from planned work for the day, anticipated work for the next day, and any other problems or assistance required. A weekly update will be submitted to the A/T on-scene coordinator. All updates will be submitted via e-mail.

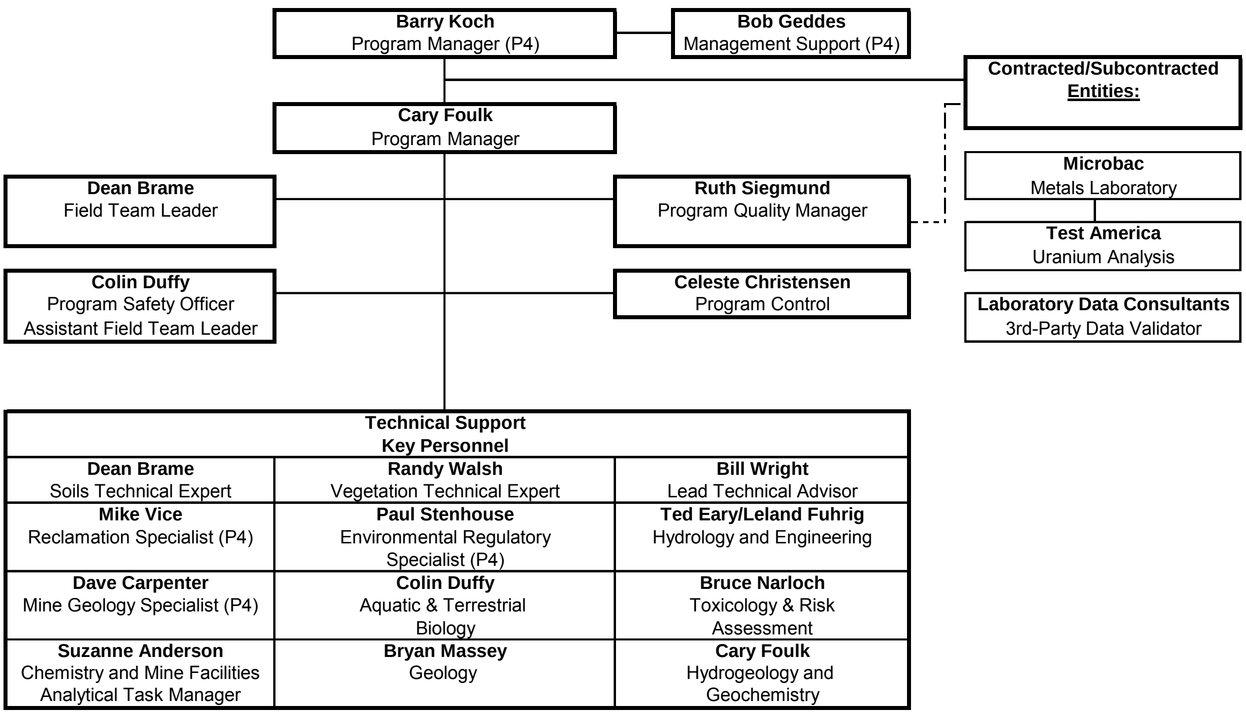

Figure 6-1: Project Organization Chart

Table 6-1: Project Contacts			
Company or Agency	**Contact**	**Title**	**Telephone**
P4 Production	Barry Koch	Special Project Lead—Mining / Program Manager	208-547-1439
	Bob Geddes	Environmental Regulatory Specialist / Management Support	208-547-1234
	Paul Stenhouse	Environmental Regulatory Specialist	208-547-1294
	Mike Vice	Mine Reclamation Specialist	208-547-1277
	Dave Carpenter	Mine Geologist	208-547-1437
Idaho Department of Environmental Quality	Mike Rowe	Program Manager and On Scene Coordinator	208-236-6160
MWH	Cary Foulk	Program Manager and Principle Hydrogeolgist / Geochemist	970-879-6260
	Bill Wright	Lead Technical Support and Principal Ecologist	425-241-7413
	Ruth Siegmund	Program Quality Manager	925-627-4756
	Dean Brame	Field Team Supervisor/ Technical Lead-Soils	425-896-4000
	Colin Duffy	Field Team Coordinator/ Program Safety Officer	425-896-4000
	Randy Walsh	Technical Lead -Vegetation	970-377-9410
	Suzanne Anderson	Analytical Task Manager and Technical & Field Support	425-896-4000
	Bryan Massey	Technical & Field Support	425-896-4000
	Leland Fuhrig	Technical & Field Support	970-879-6260
	Celeste Christensen	Project Coordinator	425-896-4000
Microbac Laboratories, Inc.	Kathy Albertson	Project Manager (primary laboratory)	800-373-4071 x179
ALS Paragon Laboratory	Amy Wolf	Project Manager (radiologic analyses laboratory)	970-490-1511
Laboratory Data Consultants, Inc	Linda Rauto	Project Manager (data validation subcontractor)	760-634-0437

6.2 Project Schedule

- Surveys – late May/early June 2009
- Soil Sampling (1 event) – Early summer between 15 June and 15 July
- Vegetation Sampling (2 events) – Early summer between 15 June and 15 July; Early fall between 17 August and 15 September.

- Data validation – within 60 days of receipt of laboratory data
- Data Summary Report – within 60 days of final, validated data set approval by the A/T

6.3 Project Deliverables

The raw data and data validation reports will be submitted to the A/T when available. Once the validated sampling data are approved by the A/T, a soil and vegetation sampling Data Summary Report (DSR) will be submitted. This report must review the investigative activities that have taken place. The report shall describe (e.g., narrative of results, field activity and data summaries, statistical analysis) and display (tables, graphs, figures, drawings, maps, etc.) the location, dimensions, physical condition, and varying concentrations of each contaminant for each source and the known extent of contaminant migration through each of the affected media. Location and characteristics of surface and subsurface features should also be included. The DSR must also evaluate data gaps and identify additional and/or modified sampling and analysis that shall be included in revisions to the SAP for each subsequent field season.

A Site Investigation report will be produced at the end of the overall site investigation. This report will include a detailed statistical analysis and evaluation of the soil and vegetation characterization data, including initial screening against risk-based screening levels.

7.0 REFERENCES

Bailey, James A. 1984. *Principles of Wildlife Management*. John Wiley and Sons. United States. 373 pp.

MWH, 2004. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan – Final, P4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P4 Production. March.

MWH, 2008. *Supplemental Waste Rock Dump Soil and Vegetation Characterization Planning Memorandum – Draft Revision 0*. Prepared for P4 Production, June 26, 2008.

IDEQ, 2008a. *Identification of Data Gaps*. Mike Rowe, IDEQ, May 2, 2008.

IDEQ, 2008b. Email communication: *P4 Monsanto – Sampling for Soil & Vegetation. Mike Rowe, IDEQ, May 30, 2008*.

IDEQ, 2008c. *Technical Memorandum Chemicals of Potential Concern to Sample for Soil and Vegetation at Ballard, Henry, and Enoch Valley Mines*. Attached to the September 16, 2008 letter from Mine Rowe (IDEQ) transmitting comments on the June 26, 2008 Supplemental Waste Rock Dump Soil and Vegetation Characterization Planning Memorandum.

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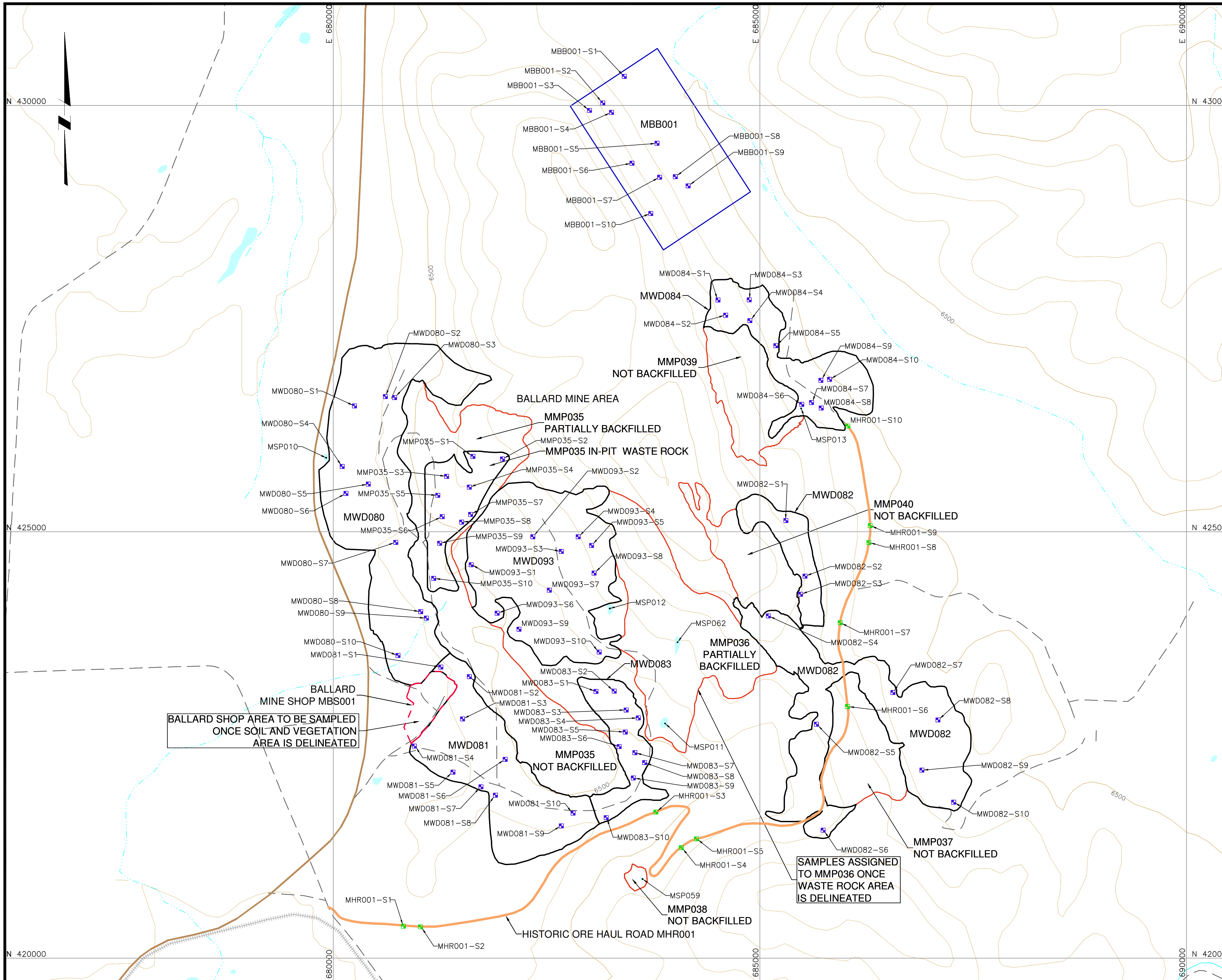

LEGEND:

- 7000 PRE-MINE GROUND SURFACE CONTOUR AND ELEVATION, FEET
- POND OR LAKE
- STREAM – PERENNIAL
- STREAM – INTERMITTENT
- RAILROAD
- MINOR ROAD
- ACTIVE ORE HAUL ROAD
- HISTORIC ORE HAUL ROAD
- WASTE ROCK PILE LOCATION
- MINE SPECIFIC BACKGROUND AREA
- MINE SITE FACILITY
- PIT BOUNDARY
- SOIL AND VEGETATION SAMPLING LOCATION
- HISTORIC HAUL ROAD SAMPLING LOCATION

(SYMBOLS ARE DRAWN TO SCALE AND REPRESENT THE 50'X50' SAMPLING AREA AT EACH SAMPLING LOCATION)

SCALE

600 0 600 1200 FEET

CONTOUR INTERVAL = 100 FEET

ISSUE	DESCRIPTION	TECH	ENG	DATE
B	ISSUE FOR INTERNAL REVIEW	CF	CD	04/09
A	ISSUE FOR INTERNAL REVIEW	DDW	CD	01/09
REV				

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2. PRE-MINE TOPOGRAPHY PROJECTION IS IDAHO EAST STATE PLANE COORDINATES, NAD 27.

DESIGNED BY	C. DUFFY	04/14/09
DRAWN BY	D. WILLIAMS	04/14/09
CHECKED BY	C. DUFFY	04/14/09
APPROVED BY	C. FOULK	04/14/09
PROJECT MANAGER	C. FOULK	04/14/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 PRODUCTION
SITE INVESTIGATION

PROJECT LOCATION
BALLARD, HENRY, AND ENOCH VALLEY MINES

PROJECT
2009 SOIL AND VEGETATION CHARACTERIZATION

TITLE
SOURCE AND BACKGROUND AREA SAMPLING LOCATIONS - BALLARD MINE

MWH

DRAWING 1

REVISION B

FILE NAME 1005813D058

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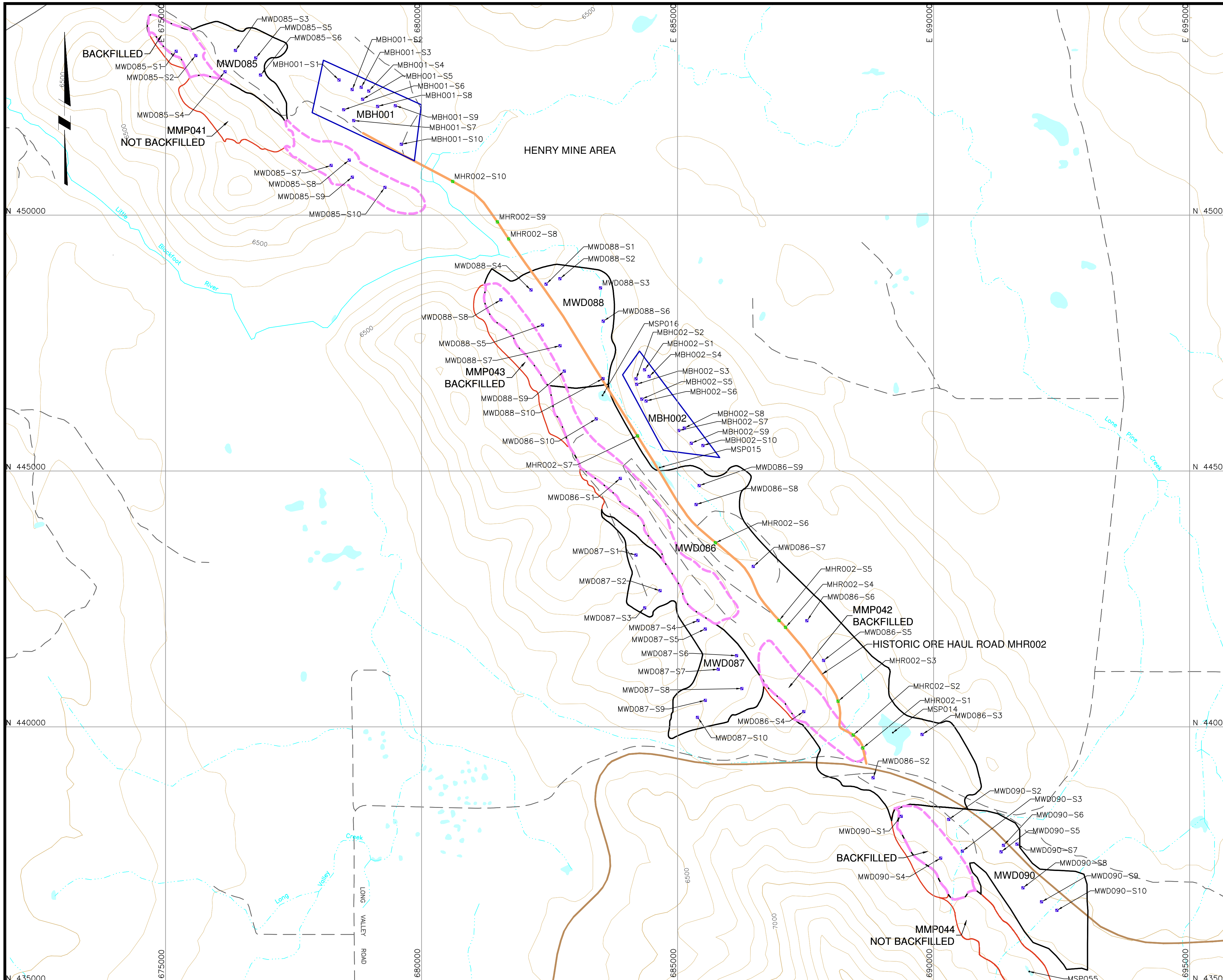

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- SOIL AND VEGETATION SAMPLING LOCATION
- HISTORIC HAUL ROAD SAMPLING LOCATION

(SYMBOLS ARE DRAWN TO SCALE AND REPRESENT THE 50'X50' SAMPLING AREA AT EACH SAMPLING LOCATION)

SCALE
1000 0 1000 2000 FEET
CONTOUR INTERVAL = 100 FEET

ISSUE	DESCRIPTION	TECH	ENG	DATE
B	ISSUE FOR INTERNAL REVIEW	CF	CD	04/09
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DRAWN BY	D. WILLIAMS	04/14/09
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PROJECT MANAGER	C. FOULK	04/14/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 PRODUCTION
SITE INVESTIGATION

PROJECT LOCATION
BALLARD, HENRY, AND ENOCH VALLEY MINES

PROJECT
2009 SOIL AND VEGETATION CHARACTERIZATION

TITLE
SOURCE AND BACKGROUND AREA SAMPLING LOCATIONS - HENRY MINE

MWH

DRAWING 2
REVISION B
FILE NAME 1005813D056

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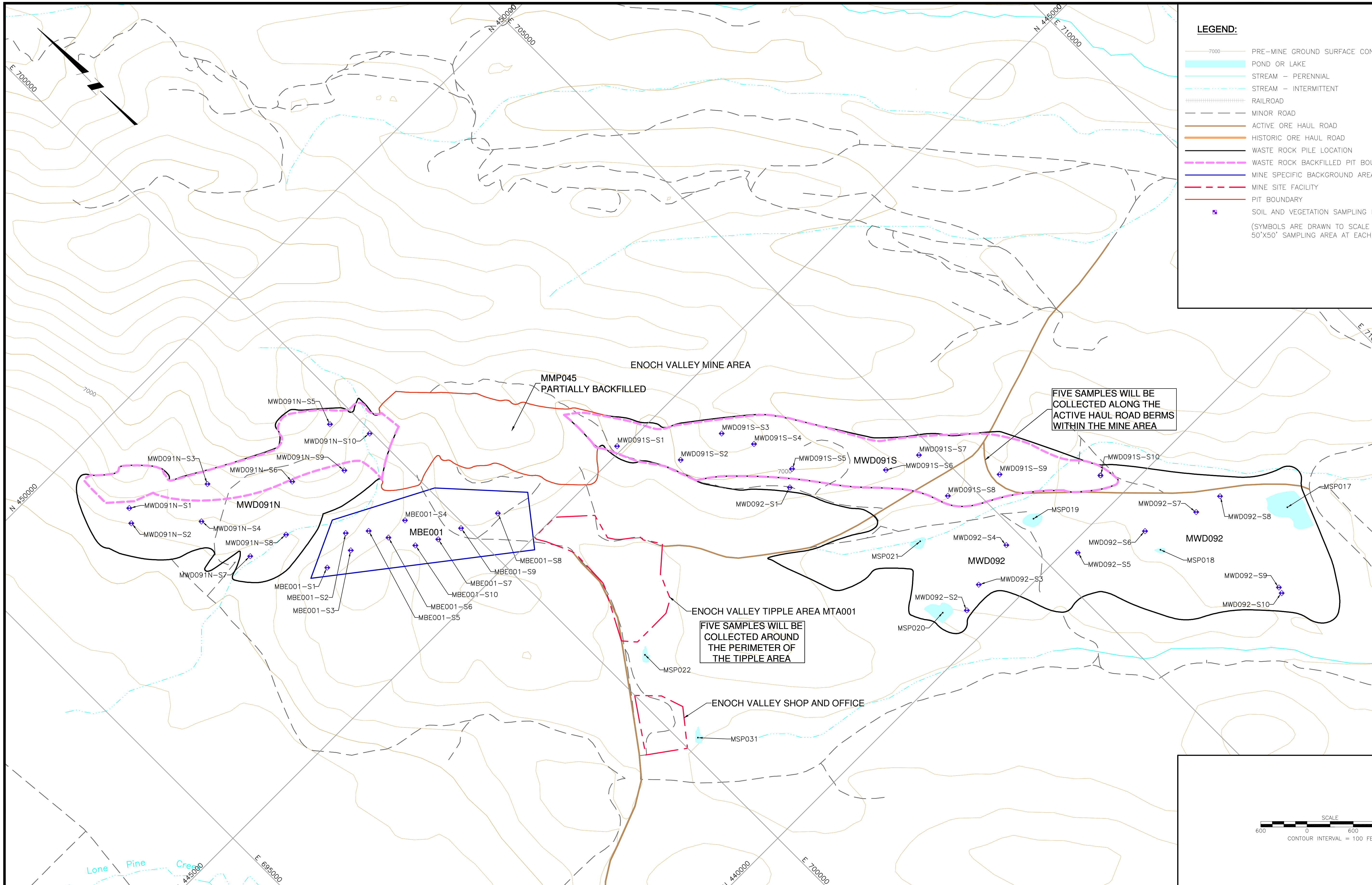

LEGEND:

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- STREAM – INTERMITTENT
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(SYMBOLS ARE DRAWN TO SCALE AND REPRESENT THE 50'X50' SAMPLING AREA AT EACH SAMPLING LOCATION)

SCALE
600 0 600 1200 FEET
CONTOUR INTERVAL = 100 FEET

ISSUE	DESCRIPTION	TECH	ENG	DATE
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DRAWN BY	D. WILLIAMS	04/14/09
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APPROVED BY	C. FOULK	04/14/09
PROJECT MANAGER	C. FOULK	04/14/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

P4 PRODUCTION
SITE INVESTIGATION

PROJECT LOCATION
BALLARD, HENRY, AND ENOCH VALLEY MINES

PROJECT
2009 SOIL AND VEGETATION CHARACTERIZATION

TITLE
SOURCE AND BACKGROUND AREA SAMPLING LOCATIONS - ENOCH VALLEY MIN E

MWH

DRAWING 3
REVISION B
FILE NAME 1005813D057

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APPENDICES

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SOURCE: FEIS

WILDLIFE SPECIES: ODOCOILEUS HEMIONUS – MULE DEER

AUTHORSHIP AND CITATION:
Snyder, S. A. 1991. Odocoileus hemionus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2009, January 14].

FOOD HABITS:
Mule deer are primarily browsers, feeding on several thousand different plant species across their range. They are capable of altering or severely damaging plant communities through over-browsing [40]. Mule deer consume leaves, stems, and shoots of woody plants most often during summer and fall, while grasses and forbs compose the bulk of spring diets. However, feeding behavior is quite variable in any given location. Some of the most common foods are: rabbitbrush (Chrysothamnus spp.), mountain-mahogany (Cercocarpus spp.), snowberry (Symphoricarpos spp.), buffaloberry (Shepherdia spp.), ceanothus (Ceanothus spp.), rose (Rosa spp.), serviceberry (Amelanchier spp.), sagebrush (Artemisia spp.), sumac (Rhus spp.), common chokecherry (Prunus virginiana), willow (Salix spp.), Gambel oak (Quercus gambellii), mockorange (Philadelphus lewisii), ninebark (Physocarpus spp.), antelope bitterbrush (Purshia tridentata), mariposa (Calochortus elegans), juniper (Juniperus spp.), yucca (Yucca spp.), euphorbia (Euphorbia spp.), manzanita (Arctostaphylos spp.), lechuguilla (Agave lechuguilla), western yarrow (Achillea millefolium), red huckleberry (Vaccinium parvifolium), sword fern (Polystichum munitum), milkvetch (Astragalus spp.), and dandelion (Taraxacum officinale). Grasses include bluegrasses (Poa spp.), wheatgrasses (Agropyron spp.), and bromes (Bromus spp.) [17,18,19,21,25,30,35,36,42,48,49,56].

REFERENCES FOR SPECIES: ODOCOILEUS HEMIONUS
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56. Wallmo, Olaf C.; Regelin, Wayne L. 1981. Rocky Mountain and Intermountain habitats. In: Wallmo, Olof C., ed. Mule and black-tailed deer of North America. Lincoln, NE: University of Nebraska Press: 387-398. [14387]

WILDLIFE SPECIES: CERVUS CANADENSIS

AUTHORSHIP AND CITATION:

Snyder, S. A. 1991. Cervus canadensis. In: Fire Effects Information System, [Online].
U.S. Department of Agriculture, Forest Service,
Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
Available: http://www.fs.fed.us/database/feis/ [2009, January 14].

FOOD HABITS:

Elk are ruminant herbivores; their food habits are extremely variable throughout their range. Some elk populations prefer to graze, while others rely more heavily on browse. Grasses and forbs are preferred during spring and early summer, and woody browse is preferred during winter. Elk browse conifers in areas where snow covers other forage. Some important elk foods include [40]: eriogonum (Eriogonum spp.), tidytips (Layia spp.), blazing-star (Mentzelia spp.), scalebud (Anisocoma acaulis), five hook bassia (Bassia hyssopifolia), alkali mallow (Sida hederacea), black alfalfa (Medicago sativa), antelope bitterbrush (Purshia tridentata), greasewood (Sarcobatus vermiculatus), galleta (Hilaria jamesi), knotgrass (Paspalum distichum), bigleaf sandwort (Arenaria macrophylla), spotted cat's-ear (Hypochoeris radicata), buckthorn plantain (Plantago lanceolata), trefoil foamflower (Tiarella trifoliata), cowparsnip (Heracleum lanatum), sedges (Carex spp.), wildrye (Elymus spp.), maple (Acer spp.), huckleberry and blueberry (Vaccinium spp.), larkspur (Delphinium spp.), western goldthread (Coptis occidentalis), lupine (Lupinus spp.), penstemon (Penstemon spp.), clover (Trifolium spp.), wheatgrass (Agropyron spp.), brome (Bromus spp.), bluegrass (Poa spp.), sagebrush (Artemisia spp.), ceanothus (Ceanothus spp.), current (Ribes spp.), and quaking aspen (Populus tremuloides).

REFERENCES FOR SPECIES: CERVIS CANADENSIS

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WILDLIFE SPECIES: ALCES ALCES

AUTHORSHIP AND CITATION:

Snyder, S. A. 1991. Alces alces. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2009, January 14].

FOOD HABITS:
Moose are generalist, ruminant herbivores. Their foods encompass several hundred species worldwide, but moose usually eat about 25 to 30 species in any one locale [43]. Throughout their range in North America, moose most commonly browse on alder (Alnus spp.), cottonwood (Populus spp.), willow, birch, aspen, and balsam fir. Following is a list of other species frequently found in moose diets: serviceberry (Amelanchier spp.), mountain ash (Sorbus spp.), bush honeysuckle (Diervilla lonicera), dogwood, mountain maple (Acer spicatum), Rocky Mountain maple (Acer glabrum), viburnum (Viburnum spp.), current (Ribes spp.), ceanothus (Ceanothus spp.), huckleberry (Vaccinium spp.), cherry (Prunus spp.), Pacific yew, and wild sarsaparilla (Aralia nudicaulis). Moose also eat various species of mushrooms, sedges (Carex spp.), grasses, such as bluegrass (Poa spp.) and brome (Bromus spp.), lichens (Peltigera spp.), and forbs, such as fireweed (Epilobium spp.) and lupine (Lupinus spp.) [1,13,16,28,34,36,38,40]. Some preferred aquatic species include water horsetail (Equisetum fluviatile), burreed (Sparganium spp.), and pondweed (Potomageton spp.) [47]. In Newfoundland Dodds [15] noted competition between snowshoe hares (Leupus americanus) and moose for browse.

REFERENCES FOR SPECIES: ALCES ALCES

1. Allen, Arthur W.; Jordan, Peter A.; Terrell, James W. 1987. Habitat suitability index models: moose, Lake Superior region. Biol. Rep. 82 (10.155). Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. 47 p. [11710]

13. Cushwa, Charles T.; Coady, John. 1976. Food habits of moose (Alces alces) in Alaska: a preliminary study using rumen contents analysis. Canadian Field-Naturalist. 90: 11-16. [13895]

15. Dodds, Donald G. 1960. Food competition and range relationships of moose and snowshoe hare in Newfoundland. Journal of Wildlife Management. 24: 52-60. [13894]

16. Edwards, Joan. 1985. Effects of herbivory by moose on flower and fruit production of Aralia nudicaulis. Journal of Ecology. 73: 861-868. [13626]

28. LeResche, Robert E.; Davis, James L. 1973. Importance of nonbrowse foods to moose on the Kenai Peninsula, Alaska. Journal of Wildlife Management. 37(3): 279-287. [13123]

34. Peterson, Randolph L. 1955. North American moose. Toronto, ON: University of Toronto Press. 280 p. [13900]

36. Pierce, John D. 1984. Shiras moose forage selection in relation to browse availability in north-central Idaho. Canadian Journal of Zoology. 62(12): 2404-2409. [12493]

38. Ritchie, Brent W. 1978. Ecology of moose in Fremont County, Idaho. Wildlife Bulletin No. 7. Boise, ID: Idaho Department of Fish and Game. 33 p. [4482]

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43. Timmermann, H. R.; McNicol, J. G. 1988. Moose habitat needs. Forestry and wildlife management in the boreal forest--an Ontario workshop; 1987 December 7-9; Thunder Bay, ON. In: The Forestry Chronicle. 1988 June: 238-245. [5118]

47. Peek, James M. 1974. Intial response of moose to a forest fire in northeastern Minnesota. American Midland Naturalist. 91(2): 435-438. [16531]

ADDITIONAL RESOURCES:

Cooperrider, A.Y.R., R.J. Boyd, and H.R. Stuart, eds. 1986 Inventory and monitoring of wildlife habitat. US Dept. Inter., Bur. Land Manage. Service Center. Denver, CO. xviii, 858 pp.

Pg 552: Although North American ungulates are opportunistic, significant differences in forage preferences are presumable a reflection of their ability to gather and digest different forage classes. Most notable of these differences is the distinction between grass eaters and browse eaters. All North American ungulates eat or browse grass when it is green, succulent and nutritious.

Pg 701-702 Measurement techniques for forage utilization: Forage utilization refers to the amount of vegetation removed by foraging animals. Measurements are expressed as the percentage of the available forage or annual forage production removed during a given season or year. Measurements may be reported by plant species or group. Total forage production is estimated by above ground biomass for each forage plant. Below ground components of the plant structure are not included as a forage production source for forage utilization.

Bailey, James A. 1984. Principles of Wildlife Management. John Wiley and Sons. United States. 373 pp.

Pg 84. Food Preferences: In contrast to carnivores, herbivores exist on comparatively crude foods, mainly carbohydrates with low concentrations of proteins and other nutrients. Herbivores feed mainly on plant species and parts of plants (buds, leaves, flowers, fruits) in which nutrients are concentrated.

Pg 97. Plant part: The chemical and physical compositions of plants vary greatly among structures (seeds, flowers, leaves, stems) and to a lesser degree among positions of structures (top or bottom of crown) on the plant. For browsing animals, diet is usually best when animals can eat only the terminal portions of the twigs, as they do when plenty of food is available. Since most of the nutrients in browse occur in the buds and terminal-most portions of the stems, this provides good nutrition. However, as food becomes scarce, animals are forced to consume more of the stem portions of the browse.

Source: Idaho Fish and Game

Moose

Dietary:

The name moose means "eater of twigs" and was given by the Algonquin, a Native American tribe. They were called twig-eaters because moose eat the roots, bark, and shoots of birch, willow, and aspen. In summer, they feed mostly on water plants such as the water lily and pondweed. They frequently wade into lakes and streams often fully submerging their large heads to reach the roots and stems at the bottom. During the winter they browse on conifers and eat their needle-like leaves. A moose requires an estimated 40 plus pounds of food every day. That's quite a meal!

Elk

Dietary:

Elk primarily graze in spring and summer but may browse on woody vegetation in winter if grasses, sedges, and forbs (low-growing, soft-stemmed plants) are unavailable. Elk need about 10 to 15 pounds of vegetation per day. In the winter, elk consume lichens (mossy plants) since they are one of the few foods available.

Mule Deer

Dietary:

Mule deer eat a wide variety of woody plants, primarily during the winter when snow covers grasses and forbs. Mule deer have a multi-part stomach with the first two chambers acting as temporary storage. Food in these chambers can be digested later when the deer chews its cud. Common plants in a mule deer's diet include aspen, dogwood, juniper and Douglas fir. They graze on various grasses, forbs, and shrubs heavily during spring, summer and fall and occasionally feed on agricultural crops.

Appendix B
Standard Operating Procedures

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SOP-NW-7.2

COLLECTION OF SOIL SAMPLES

1.0 SUMMARY AND SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of soil samples using hand operated devices. This SOP does not describe sampling procedures for lithified deposits or rocks or sampling procedures using drill rigs. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of soil sampling and is intended to be used in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

2.0 DEFINITIONS

None.

3.0 HEALTH AND SAFETY WARNINGS

Safety glasses should be worn at all times when taking soil samples to protect from dust particles. Care should be taken to minimize the disruption of the soil to minimize dust. A deionized water spray bottle may be used to dampen the earth and minimize dust if necessary.

4.0 PERSONNEL RESPONSIBILITIES

4.1 Field Sampling Engineer

The Field Sampling Engineer (or field team member) is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements

4.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

4.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, soil sampling forms, generated data, and other associated and pertinent project information.

4.4 QA Manager

The QA Manger is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

5.0 DISCUSSION

The methods described by this procedure may be used to acquire soil samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

6.0 PROCEDURE

The sampling method described in this SOP is suitable for collecting soil samples. Because of the potentially high degree of heterogeneity found in soils, the collection of representative samples requires careful planning and considerable technical judgment. Sampling locations shall be as specified in the governing workplan or SAP. However, the preferred sampling strategy requires collection of subsamples from the specified sample location and compositing of those subsamples in the field to form a single sample before shipment.

6.1 Equipment List

The following is a list of required equipment for performing soil sampling:

- Copy of this SOP and applicable workplan or SAP
- Balance with a 250-gram capacity calibrated to ± 0.1 grams (optional)
- Bound field notebook
- Sterilized latex or nitrile gloves
- Decontamination equipment and waste containers
- Detergent solution (0.1 to 0.3 percent Alconox or equivalent detergent)
- Distilled water
- Hand-operated soil collection device
- 100-ft measuring tape
- Sample bags
- Sample containers
- Sample labels and seals
- U.S. Standard Sieve No. 10 with collection pan and cover (optional)
- Site map of sampling area
- Soil sample collection form (see attachment)
- Soil coring device
- Stainless steel mixing bowl
- Stainless steel spoon or hand shovel

Criteria for selecting appropriate soil samples will follow ASTM Standard D 4700-91, Standard Guide for Soil Sampling from the Vadose Zone (ASTM, 1998).

6.2 General Considerations

The selection of sampling locations shall be as specified in the applicable workplan or SAP. The sampling site shall be photographed if so specified in the governing workplan or SAP. Samples will be composited in a manner specific to each sample location; compositing is described in Section 6.2.1. In addition, to remove residual organic matter and large soil particles, each soil sample designated for trace metals analysis may be sieved prior to shipment, if required by the governing workplan or SAP. The sieve procedure is described in Section 6.2.2. During soil sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan.

6.3 Soil Sampling

The procedures for collecting one soil sample at a given location is as follows:

- Using decontaminated sampling equipment under the protocols described in Section 6.5, collect soil from the interval of concern or to refusal of the equipment.
- If the equipment is refused, record the depth of refusal.
- Retain the soil in a decontaminated, stainless steel mixing bowl.

If two or more samples are to be collected from differing depths at a single sample location, the procedure for collecting soil is as follows:

- If the upper layer of topsoil is to be collected, begin by driving a clean stainless steel sample coring device two inches into the ground with a hammer until the top of the box is flush with the ground.
- Remove the material within the coring bit to the required depth with a decontaminated stainless steel scoop or spade.
- Retain the sample in a clean, stainless steel mixing bowl.
- If an additional sample is required at a depth below the topsoil sample, remove at least one-inch of soil and discard.
- If no topsoil sample is collected, remove soil to the top of the desired sample interval from an area having a minimum diameter of eight inches to avoid cross-contaminating soil layers using a decontaminated stainless steel tile spade.
- Using decontaminated sampling equipment under the protocols described in Section 5.5, collect soil from the interval of concern or to refusal of the equipment.

- Retain the soil in a clean stainless steel mixing bowl.

- If additional samples are required at deeper intervals, repeat procedure until refusal.

6.3.1 Compositing

If soil samples are collected at a particular location, the following procedure will be used for compositing:

- Combine each sample in a decontaminated stainless steel mixing bowl.

- Mix the contents of the mixing bowl for several minutes.

- Remove material other than soil, such as litter, root matter, and rocks. Shake soil material from roots and sod.

- Mix again for several minutes to obtain a homogeneous mixture.

- Fill designated sample containers with the homogenized soil mixture as discussed in Section 6.5.

- Retain or dispose of the remaining soil mixture as specified in the applicable workplan or SAP.

Homogenization of samples may also occur at the analytical laboratory, per the governing workplan or SAP. Thus, field homogenization would not be necessary.

6.3.2 Sieving

Soil collected for the analysis of trace metals shall be sieved to remove residual organic detrius and larger soil particles if required by the governing SAP or workplan. Sieving will follow the following procedure:

- Place soil in top of a sieve having a maximum opening size of 2.0 mm and equipped with a collection pan, cover and manually agitate.

- At the end of sieve procedure, weigh soil particles that are retained on the sieve and the collection pan.

- Discard soil particles retained on the sieve.

Sieving of samples may also occur at the analytical laboratory, per the governing workplan or SAP. Thus, field sieving would not be necessary.

6.4 Sample Acquisition Methods

6.4.1 Thief Sampler

The "thief" sampler consists of two slotted concentric stainless steel tubes with a pointed tip. The inner tube may be rotated to isolate the sampler interior. It is recommended for use in the sampling of dry granular or powdery soils with a particle diameter less than one third the width of its slots. To take a sample, close the sampler and insert it into the soil to the desired sampling interval.

Theif Sampler

Rotate the inner tube to open the sampler, and tap gently to induce a flow of soil into the interior. Close the sampler, withdraw it from the soil, and lay it horizontally, with the slots facing up. Remove the inner tube and transfer the sample to an appropriate sample container or decontaminated compositing bowl.

6.4.2 Sampling Trier

The sampling trier is recommended for use in cohesive soils with a particle size less than half the trier diameter. To acquire a sample, insert the trier into the sampling interval at a 45 degree angle, and rotate the handle 360 degrees to cut soil core. Withdraw the trier with the concave side up, and transfer the sample material to an appropriate sample container or decontaminated compositing bowl.

Sampling Trier

6.4.3 Slide Hammer Core Sampler

The slide hammer core sampler is recommended for use in rockier soils and soils with a hard, compact surface.

To prepare the sampler for coring, take the following steps:

- Insert a suitable liner into the body (cup);
- Thread the top cap to the upper end of the cup and tighten;
- Attach the extension to the top of the sampler and tighten;

- Attach the slide hammer to the extension and tighten.

To collect a core sample, raise the slide hammer body and allow it to fall to drive the sampler into the soil. Continue until the sampler has been driven to its length. Remove the sampler by tilting and lifting horizontally. Disconnect the sampler from the extension and slide hammer using wrenches if necessary. Keeping the sampler vertical, remove the top cap carefully, using a slip wrench if necessary. Remove the filled liner by first extruding it from the body by pushing up from the sampler lower end. Empty the sample into the appropriate container or compositing bowl. Use a decontaminated liner for each sample.

6.4.4 Portable Auger

Hand- or electric motor-operated portable augers should generally be used in hard-packed soils or sediments. Because of the potential for site contamination, gasoline-powered augers are not permitted unless specifically authorized by approved project-specific plans. To acquire a sample, insert the auger through the catchpan at the desired sampling location and rotate the auger to the required sampling interval. Withdraw the auger and transfer the sample material in the catchpan (or that may have adhered to the auger surface) to an appropriate sample container or decontaminated compositing bowl using a decontaminated stainless steel spoon, trowel, or spatula.

6.4.5 Grab Samples

When permitted by site-specific project plans, grab samples may be taken with a decontaminated shovel or trowel and directly transferred to an appropriate sample container or decontaminated compositing bowl.

6.5 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for soil samples are as follows:

- If specified in the site workplan or SAP, a photograph should be taken of the soil sample.
- Using a decontaminated stainless steel scoop, empty each soil sample in the mixing bowl to composite.
- Fill the container with a portion of the composited sample. Attempt to maintain the proportion of solids that exist in the mixing bowl while filling containers.
- Store sample containers in coolers for transportation in compliance with the sample handling and chain-of-custody requirements specified in the workplan or SAP.
- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

During soil sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan to minimize cross-contamination.

6.6 Decontamination

Sample acquisition and compositing tools shall be decontaminated as follows:

1. Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available.

2. Scrub the sample acquisition or compositing tool with a brush and rinse with deionized or distilled water.

3. Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.

4. Wrap the decontaminated device in clean plastic sheeting or bags and tape securely pending next use.

7.0 RECORDS MANAGEMENT

The attached Soil Sample Collection Form is to be completely filled out for each corresponding soil sample. This form should be reproduced in a field book along with any notes or unexpected events that may accompany the effort.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

The approved quality assurance and quality control measures will be applied as described in the applicable workplan or quality assurance plan.

9.0 REFERENCES

ASTM D4700-91 (1998)e1. "Standard Guide for Soil Sampling from the Vadose Zone". ASTM International. Available: www.astm.org

SOIL SAMPLE COLLECTION FORM

Project:____ **Project Number:** _______________

Date: ____/______/______ **Time:** _____________

Field Personnel: _________________________ **Signatures**: _________________________

_________________________ _________________________

_________________________ _________________________

SITE DESCRIPTION

Site Location: ____

Station Number: ____________ **Photo. No.:** ______________ **Roll No.:** __________

GPS Coordinates: **Latitude** ______°_______´_______´´ **Longitude** ______°_______´ ´´ _

Elevation_____________________

Comments/Descriptions:____

____

____

____

FIELD DESCRIPTION

Sample Identification Number: __________________

Soil Characteristics (color, appearance, structure): ____

____

____

____

Collection Method: ____

Sieve Analysis: Size _______________ **Weight Retained** _______________

Comments/Descriptions: ____

____

____

____

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SOP-NW-9.0a

SOIL AND WASTE ROCK DUMP COVER MATERIAL CLASSIFICATION SPECIFIC FOR P4 PRODUCTION LLC SITE INVESTIGATION

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STANDARD OPERATING PROCEDURE 9.0a

SOIL AND WASTE ROCK DUMP COVER MATERIAL CLASSIFICATION SPECIFIC FOR P4 PRODUCTION LLC SITE INVESTIGATION

TABLE OF CONTENTS

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(continued)

LIST OF TABLES
(Tables follow the end of this SOP)

1.0 INTRODUCTION

This standard operating procedure (SOP) is intended for use as a guide for soil logging procedures at sites requiring surficial soil investigation. The SOP employs the Unified Soil Classification System (USCS) and the ASTM Standard D 2488 - 00 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM, 2000). These procedures have been modified for the identification of waste rock dump cover materials used at the P4 Production LLC (P4) mine areas in southeastern Idaho. Variance from the logging procedures described herein will be warranted only if reviewed and approved by the Project Manager. A thorough working knowledge of this SOP is critical for field personnel to standardize logging procedures and to enable subsequent correlation between sample locations at a site, allowing for accurate site characterization.

The information described in this SOP is summarized on the USCS chart. Copies of this chart will be available for all field personnel. Note that many references (e.g., AGI Data Sheet grain-size scales) base soil classifications on the Wentworth Scale. Such scales may vary significantly from the USCS and may lead to inaccurate or inconsistent soil descriptions.

2.0 DEFINITIONS

Use of the USCS requires familiarity with the grain size ranges that define a particular type of soil, as well as several other physical characteristics. The grain size definitions and physical characteristics upon which soil descriptions are based are presented below. This information is also presented in tabular format on the Unified Soil Classification System matrix.

2.1 GRAIN SIZES

USCS grain sizes are based on U.S. standard sieve sizes, which are defined as follows:

- Standard sieves with larger openings are named according to the size of the openings in the sieve mesh. For example, a "No.3" sieve contains openings that are 3 inches (in.) square.
- Standard sieves with smaller openings are given numbered designations that indicate the number of openings per square inch. For example, a "No. 4" sieve contains 4 openings per square inch.

The following grain size definitions are paraphrased from the ASTM Standard D 2488 - 00. Field personnel will familiarize themselves with the grain size definitions and refer to the appropriate field guide for a visual reference.

Boulders: Particles of rock that will not pass a 12-in. (300-millimeter [mm]) square opening.

Cobbles: Particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. or 75 mm sieve.

Gravel: Particles of rock that will pass a 3-in (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

Coarse Gravel: Passes a 3-in. (75-mm) sieve and is retained on a 3/4-in. (19-mm) sieve

Fine Gravel: Passes a 3/4-in. (19-mm) sieve and is retained on a No. 4 (0.19 in. or 4.75-mm) sieve

Sand: Particles of rock that will pass a No. 4 (0.19 in. or 4.75-mm) sieve and be retained on a No. 200 (0.0029 in. or 75-micrometer [μm]) sieve with the following subdivisions:

Coarse Sand: Passes a No. 4 (0.19 in. or 4.75-mm) sieve and is retained on a No. 10 (0.079 in. or 2-mm) sieve

Medium Sand: Passes a No. 10 (0.079 in. or 2-mm) sieve and is retained on a No. 40 (0.017 in. or 425-µm) sieve

Fine Sand: Passes a No. 40 (0.017 in. or 425-µm) sieve and is retained on a No. 200 (0.0029 in. or 75-µm) sieve

Silt: Soil passing a No. 200 (0.0029 in. or 75-µm) sieve that is non-plastic or very slightly plastic, and that exhibits little or no strength when air-dried. Individual silt particles are not visible to the naked eye.

Clay: Soil passing a No. 200 (0.0029 in. or 75-µm) sieve that can be made to exhibit plasticity within a range of moisture contents, and that exhibits considerable strength when air-dried. Individual clay particles are not visible to the naked eye.

2.2 PHYSICAL CHARACTERISTICS

The physical characteristics described below are used in the USCS classification for fine-grained soils. A brief definition of each physical characteristic is presented. Physical characteristics of coarse-grained soils and consolidated rock are presented in Section 4.2. Tables 9-1 through 9-4 present descriptions of field tests that may be performed to estimate physical properties in a field sample. However, with the exception of plasticity, the tests are generally too time-consuming to perform regularly in the field. A determination of the type of fine-grained soil present in the sample can generally be made on the basis of plasticity, as described in Section 4.1.2.

Dry Strength: The ease with which a dry lump of soil crushes between the fingers (Table 9-1).

Dilatancy Reaction: The speed with which water appears in a moist pat of soil when shaken in the hand, and disappears while squeezing (Table 9-2).

Toughness: The strength of a soil, moistened near its plastic limit, when rolled into a 1/8-in. diameter thread (Table 9-3).

Plasticity: The extent to which a soil may be rolled into a 1/8 in. thread, and re-rolled when drier than the plastic limit (Table 9-4).

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information will be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel will always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

Project Manager: Defines objectives of fieldwork and oversees preparation of plans with input from the Project Hydrogeologist/Field Team Leader. Also oversees and prepares subcontracts.

Quality Control Manager: Performs project audits. Ensures project-specific data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Project Hydrogeologist, Geologist, or Engineer: Implements field program, records and reviews sampling logs, and prepares daily logs of field activities.

Field Technician: Assists the FTL and/or field geologist, hydrogeologist, or engineer in the implementation of field tasks.

4.0 SOIL LOGGING PROCEDURES

The following aspects of a project will be considered before sampling and soil logging commences. This information is generally summarized in a project-specific work plan or field sampling plan, which will be thoroughly reviewed by all field personnel prior to the initiation of work.

- Purpose of the soil logging (e.g., initial investigation, subsequent investigation, remediation, etc).
- Known or anticipated setting including soil types, stratigraphy (i.e., consolidated/unconsolidated, depositional environment, presence of fill material, etc.).
- Previous soil classification work (these should be carried to the field for reference).
- Soil sampling program details.
- Health and safety requirements.
- Regulatory requirements.

The procedures used to determine the correct soil sample classification are described below.

4.1 FIELD CLASSIFICATION OF SOILS

These procedures will generally be used in native soil areas. For cover materials, a set classification has been developed as the result of prior reclamation at the inactive mine sites. This classification is described in Section 4.3. However, the procedures described in this section and the following Section 4.2, will need to be applied at an appropriate level to identify the type of material per the cover material classification system. In addition, some waste rock dump cover material may not fit into the cover material classification. In this case, the general procedures outlined here for soil classification will need to be used.

The following soil classification procedures are based on the ASTM Standard D 2488 - 00 for visual-manual identification of soils (ASTM, 2000). When identifying soils, the proper USCS soil group name is given, followed by the group symbol. For clarity, the group symbol will be placed in parentheses after the written soil group name. Alternatively, a separate column may be designated for the group symbol.

Soil identification using the visual-manual procedures is based on naming the portion of the soil sample that will pass a 3-in. (75-mm) sieve. Therefore, before classifying a soil, any particles larger than 3 inches (cobbles and boulders) will be removed, if possible. The percentage of cobbles and boulders will be estimated and recorded.

Using the remaining soil, the next step of the procedure is to estimate the percentages, by dry weight, of the gravel, sand, and fine fractions (particles passing a No. 200 sieve). The percentages will be estimated to the closest 5 percent. In general, the soil is *fine-grained* (e.g., silt or clay) if it contains 50 percent or more fines, and *coarse-grained* (e.g., sand or gravel) if it contains less than 50 percent fines. If one of the components is present but estimated to be less than 5 percent, its presence is indicated by the term *trace*. For example, 'trace of fines' will be added as additional information following the formal USCS soil description.

Procedure for Identifying Coarse-Grained Soils: If the sample has been determined to contain less than 50 percent fines, the soil may be classified as either *gravel* (if the percentage of gravel is estimated to be more than the percentage of sand), or *sand* (if the percentage of gravel is estimated to be equal to or less than the percentage of sand).

If the soil is predominantly sand or gravel but contains an estimated 15 percent or more of the other coarse-grained constituent, the words "with gravel" or "with sand" will be added to the group name. For example: "gravel with sand (GP)." If the sample contains any cobbles or boulders, the words "with cobbles” or "with cobbles and boulders" will be added to group name. For example: "silty gravel with cobbles (GM)".

5 Percent or Less Fines: The soil is a 'clean gravel' or 'clean sand' if the percentage of fines is estimated to be 5 percent or less. 'Clean' is not a formal USCS name, but rather a general descriptor for implying little to no fines. Clean sands and gravels are given the USCS designation as either *well graded* or *poorly graded*, as described below.

The soil sample is *well-graded gravel* (GW), or *well-graded sand* (SW), if it has a wide distribution of particle sizes and substantial amounts of the intermediate particle sizes. On the other hand, the soil sample is a *poorly-graded gravel* (GP) or *poorly-graded sand* (SP) if it consists predominantly of one grain size (uniformly graded), or has a distribution of sizes with some intermediate sizes obviously missing (gap- or skip-graded).

<u>NOTE:</u> When using the USCS, keep in mind the differences between grading and sorting. The term grading is used to indicate the size class of particles contained in the sample, while sorting refers to the range of the particle sizes on either side of the average particle size. For example, poorly-graded sand containing predominantly one grain size would be considered well-sorted, and vice-versa. One notable exception to this general rule is a skip-graded (bi-modally distributed) sample: sand containing two distinct grain sizes would be considered both poorly-sorted and poorly-graded. The USCS uses only the *GRADING* descriptor in soil naming, not the sorting descriptor.

15 Percent Fines: If the percentage of fines is estimated to be 15 percent or more, the soil may be classified as *silty or clayey gravel* or *silty or clayey sand*. For example, a soil can be identified as *clayey gravel* (GC) or *clayey sand* (SC) if the fines are clayey, or as *silty gravel* (GM) or *silty sand* (SM) if the fines are silty. The coarse-grained descriptor "poorly-graded" or "well-graded" is not included in the soil name, but rather, will be included as additional information following the formal USCS soil description.

>5 Percent but <15 Percent Fines: If the soil is estimated to contain greater than 5 percent and less than 15 percent fines, the soil sample will be designated with a dual identification using two group symbols. The first group symbol will correspond to the clean gravel or sand portion of the sample (i.e., GW, GP, SW, SP) and the second symbol will correspond to the clayey/silty gravel or sand portion (i.e., GC, GM, SC, SM).

The group name will correspond to the first group symbol, and include the words "poorly-graded" or "well-graded", plus the words "with clay" or "with silt" to indicate the character of the fines. For example, "poorly-graded gravel with silt" would have the symbol GM, and “poorly graded gravels or gravel-sand mixtures” would have the symbol GP.

Procedure for Identifying Fine-Grained Soils: The USCS classifies inorganic, fine-grained soils according to their degree of plasticity and other physical characteristics defined in Section 2.2 and Tables 9-1 through 9-4 (i.e., soil sample with no or low plasticity is indicated with an "L"; and soil sample with high plasticity is indicated with an "H"). As indicated in Section 2.2, the field tests used to determine dry strength, dilatancy, and toughness are generally too time-consuming to be performed on a routine basis. However, the field test for plasticity can be easily performed. While field personnel will be familiar with the definitions of the physical characteristics and concepts of the field tests, field classifications will generally be based primarily on plasticity. <u>NOTE:</u> if precise engineering properties are necessary for the project (e.g., construction or modeling) geotechnical samples will be collected for laboratory testing. The results of the laboratory tests will be compared to the field logging results. Characteristic physical properties of fine-grained soils are listed below.

Silt (ML): the soil has no to low dry strength, slow to rapid dilatancy, and low toughness and plasticity, or is nonplastic.

Lean clay (CL): inorganic clay soil with medium to high dry strength, no or slow dilatancy, medium toughness, and slightly plastic.

Organic soil (OL or OH): the soil contains enough organic particles to influence the soil properties. Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, from black to brown, when exposed to the air. Organic soils normally will not have a high toughness or plasticity.

Elastic silt (MH): the soil has low to medium dry strength, no to slow dilatancy, and low to medium toughness and plasticity; will air dry more quickly than lean clay and have a smooth, silky feel when dry.

Fat clay (CH): soil has high to very high dry strength, no dilatancy, and high toughness and plasticity.

Other Modifiers for use with Fine-Grained Soils:

15 Percent to 25 Percent Coarse-Grained Material: If the soil is estimated to have 15 percent to 25 percent sand or gravel, or both, the words "with sand" or "with gravel" (whichever is predominant) will be added to the group name. For example: "lean clay with sand (CL)" or "silt with gravel (ML)". If the percentage of sand is equal to the percentage of gravel, use "with sand".

30 Percent Coarse-Grained Material: If the soil is estimated to have 30 percent or more sand or gravel, or both, the words "sandy" or "gravelly" will be added to the group name. Add the word "sandy" if there appears to be the same or more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy silt (ML)", or "gravelly fat clay (CH)".

Procedure for Identifying Borderline Soils: To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example, a soil containing an estimated 50 percent silt and 50 percent fine-grained sand may be assigned a borderline symbol "SM/ML". Borderline symbols will not be used indiscriminately. Every effort will be made to first place the soil into a single group and then to estimate percentages following the USCS soil description.

4.2 DESCRIPTIVE INFORMATION FOR SOILS

After the soil name and symbol are assigned, the soil color, consistency/density, and moisture content will be described in that order. Other information is presented later in the description, as applicable.

Color: Color is an important property in identifying both inorganic and organic soils, and may also be useful in identifying materials of similar geologic or depositional origin in a given location. Munsell Soil Color Charts or Rock Charts will be used.

When using Munsell Soil Color Charts, use the appropriate color charts to assign the applicable color name and Munsell symbol to a wet soil sample (colors change as moisture content changes, and all color descriptions will be made on wet soil for consistency). The ability to detect minor color differences varies among people, and the chance of finding a perfect color match in the charts is rare. Keeping this in mind will help field personnel avoid spending unnecessary time and effort going through the chart pages. In addition, attempts to describe soils in detail beyond the reasonable accuracy of field observations may result in less accurate soil descriptions than would be achieved by simple expression of the dominant colors (Munsell Soil Color Chart, 1992). All soil color information will be recorded in the field logbook or field forms.

It should be noted that soil color may also be impacted by contamination. To the extent possible, information pertaining to color impacted by such factors will also be recorded on the boring logs.

Consistency/Density: For intact fine-grained soil, consistency will be described as very soft, soft, medium stiff, stiff, very stiff, or hard per the field test described in Table 9-6 to determine consistency/density. For coarse-grained soils, density descriptions include very loose, loose, medium dense, dense, and very dense (Table 9-5). The estimate of density will be made based on observation as described in Table 9-6. This and other pertinent information will be clearly indicated in the field log book on the field boring-log.

Moisture: Moisture condition of the soil will be described as dry (absence of moisture, dusty, dry to the touch), moist (damp but no visible water), or wet (visible free water, saturated).

Angularity: If appropriate, describe the angularity of the sand (coarse sizes only), gravel, cobbles, and boulders, as angular, sub-angular, sub-rounded, or rounded in accordance with the following criteria:

Angular:	Particles have sharp edges and relatively planar sides with unpolished surfaces
Sub-angular:	Particles are similar to angular description but have rounded edges
Sub-rounded:	Particles have nearly planar sides but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges.

A range of angularity may be stated, such as "sub-rounded to rounded."

Grain Size: The maximum particle size found in the sample will be described in accordance with the following information:

Sand Size:	If the maximum particle size is a sand size, describe as fine, medium, or coarse. (See Section 2 for sand size definitions.)
Gravel Size:	If the maximum particle size is a gravel size, describe the diameter of the maximum particle size in inches.

Cobble or Boulder Size: If the maximum particle size is a cobble or boulder size, describe the maximum dimension of the largest particle.

For gravel and sand components, describe the range of particle sizes within each component; for example, "about 20 percent fine to coarse gravel, about 40 percent fine to coarse sand".

Carbonate Content: The presence of calcium or magnesium carbonates may be confirmed on the basis of effervescence with dilute hydrochloric acid (HCl). Proper health and safety precautions will be followed when mixing, handling, storing, or transporting HCl. The reaction with HCl should be described as none, weak, moderate or vigorous.

Structure: Structure of intact soils will be described in accordance with the criteria in Table 9-7. Generally, with surficial soil sampling this is difficult to describe unless a test pit is advanced.

Lithology/Mineralogy: Describe the lithology (rock or mineral type) of the sand, gravel, cobbles, and boulders, if possible. It may be difficult to determine the lithology of fine and medium-grained sand or particles that have undergone alteration.

Additional Comments: Additional comments may include the presence of roots or other vegetation, fossils or organic debris, staining, mottling, and iron and magnesium oxidation.

4.3 COVER MATERIAL CLASSIFICATION

The cover material typically used at P4’s inactive mines includes:

- topsoil cover,
- topsoil stockpile,
- black shale

- brown shale, and
- cherty shale.

Before conducting surveys of the waste rock cover materials, the field personal should be instructed in the field by P4 mine staff as to the correct identification of the cover materials. The general description of the cover material types follows.

Topsoil Cover: Topsoil cover material is soil that was recovered prior to mining, stockpiled, then used as waste rock cover after waste rock dump construction was completed. This material may have a range of soil characteristics but will have the general character of topsoil in the surrounding areas. The rock content should be less than 50%, with some organic content.

Topsoil Stockpile: Stockpiled soil to be used in reclamation per item above.

Black Shale: Shale is a fissile mudstone composed of lithified clay and silt sized rock particles. Black shale has a high organic content giving it the black color. The hardness of black shale is such that it may readily be scratched by a pocket knife or similar tool (P4 has restrictions on the use of knives; these restriction need to be complied with and a nail can be carried for this purpose.). For the cover material classification, any cover that contains greater that 50% black shale will be given the black shale classification. It needs to be noted that shale will readily breakdown to small fragments, so the fine gravel to sand sized fraction needs to be considered in the assessment.

Brown Shale: Brown shale is black shale that has weathered in place prior to being excavated. This material will be generally similar to the black shale except lighter colored, and will generally include more disaggregated clay and silt sized material. The brown shale material is rock that is in the process of becoming a soil, so that it has characteristics of both, but will have at least 30% shale fragments for this classification.

Cherty Shale: Will generally have the character of the black and possibly the brown shale; however, it will have a higher percentage of blocky, hard rock fragments. Chert is an amorphous silica rock, and as such may appear somewhat glassy and is hard enough that a knife or similar tool cannot scratch it. Cherty shale is a silica-rich shale that may have the appearance of shale, but is notably harder. Areas with rock fragments greater that 50% hard shale and chert should be classified as cherty shale cover.

Other cover types may be locally present, such as limestone or mixed cover materials. Where these materials are encountered, they will be noted. Limestone can be identified through using the HCl test described in Section 4.2.

5.0 REFERENCES

ASTM, 2000, Standard D 2488 - 00 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). ASTM International, West Conshohocken, PA, 9p.

Macbeth, 1992, Munsell Soil Color Charts.

TABLE 9-1

CRITERIA FOR DESCRIBING DRY STRENGTH

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.
Very High	The dry specimen cannot be broken between the thumb and a hard surface.

TABLE 9-2

CRITERIA FOR DESCRIBING DILATANCY

Description	Criteria
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

TABLE 9-3

CRITERIA FOR DESCRIBING TOUGHNESS

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

TABLE 9-4

CRITERIA FOR DESCRIBING PLASTICITY

Description	Criteria
Non-plastic	A 1/8-in. (3-mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

TABLE 9-5

DENSITY/CONSISTENCY BASED UPON BLOW COUNTS (not used)

Density (Sand and Gravel) Blows/ft*				Consistency (Silt and Clay) Blows/ft*			
Term	1.4" ID	2.0" ID	2.5" ID	Term	1.4" ID	2.0" ID	2.5" ID
very loose	0-4	0-5	0-7	very soft	0-2	0-2	0-2
loose	4-10	5-12	7-18	soft	2-4	2-4	2-4
medium dense	10-29	12-37	18-51	medium stiff	4-8	4-9	4-9
dense	29-47	37-60	51-86	stiff	8-15	9-17	9-18
very dense	>47	>60	>86	very stiff	15-30	17-39	18-42
				hard	30-60	39-78	42-85
				very hard	>60	>78	>85

* 140 lb. hammer dropped 30 inches

TABLE 9-6

CRITERIA FOR DESCRIBING CONSISTENCY

Description	Criteria
Very soft	Thumb will penetrate soil more than 1 in. (25 mm).
Soft	Thumb will penetrate soil about 1 in. (25 mm).
Firm	Thumb will indent soil about 1/4 in. (6 mm).
Hard	Thumb will not indent soil but readily indented with thumbnail.
Very Hard	Thumbnail will not indent soil.

TABLE 9-7

CRITERIA FOR DESCRIBING STRUCTURE

Description	Criteria
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick; note thickness.
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.
Homogeneous	Same color and appearance throughout.

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MONTGOMERY WATSON HARZA

SOP-NW-19.0

COLLECTION OF VEGETATION SAMPLES

1.0 SUMMARY AND SCOPE

The purpose of this document is to define the standard operating procedure (SOP) for vegetation sampling performed by MWH personnel. This SOP is intended to be used in conjunction with the governing project-specific workplan or sampling and analysis plan (SAP).

2.0 DEFINITIONS

None.

3.0 HEALTH AND SAFETY WARNINGS

Safety glasses should be worn at all times when taking vegetation samples to protect from dust and other debris, especially during periods of high wind. When clipping and handling vegetation, care should be taken as not to cut oneself with the scissors or on the plant itself.

4.0 PERSONNEL RESPONSIBILITIES

4.1 Field Sampling Engineer

The Field Sampling Engineer (or field team member) is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

4.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

4.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain-of-custody forms, field sampling forms, generated data, and other associated and pertinent project information.

4.4 QA Manager

The QA Manger is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

5.0 DISCUSSION

The methods described by this procedure may be used to acquire vegetation samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

6.0 PROCEDURE

The sampling method described in this SOP is suitable for collecting vegetation samples.

6.1 Equipment List

The following is a list of equipment that may be necessary to perform vegetation sampling:

- Bound field notebook
- Copy of this SOP and the governing workplan or SAP
- Detergent solution (0.1 to 0.3 percent Alconox)
- Distilled water
- Hand scoop, trowel, or shovel
- 100-foot long tape measure with 0.1-inch subdivisions
- Plant identification handbook
- Sterilized latex or nitrile gloves
- Stainless steel scissors or other equivalent cutting instrument
- Sample analysis request forms
- Sample containers (paper or polyethylene bags having at least an one-quart capacity)
- Sample labels and seals
- Sample location maps or sketches
- Balance with a 250-gram capacity calibrated to ±0.1 gram
- Balance calibration mass
- Camera
- Vegetation sample collection form (see attachment)

The governing workplan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the workplan or SAP for any equipment not listed in this SOP.

6.2 General Considerations

Vegetation sampling locations and vegetation types to be sampled at each location shall be as specified in the governing workplan or SAP. If specified by the workplan or SAP, sampling locations shall be photographed prior to sample acquisition. Plant samples must be identified, collected, and sorted by individual species unless otherwise indicated in the workplan or SAP. Samples will be collected of each species sampled, as described in the workplan or SAP. Minimum sample weights required by individual laboratories should be reviewed prior to field sampling.

If the workplan or SAP requires dust-free samples, the samples must be washed gently in the field with distilled water containing 0.1 to 0.3 percent Alconox and rinsed twice with distilled water to remove dust or other potential contaminants that may interfere with tissue concentration results. Plant samples should not to be washed if the investigation goals are to determine potential contamination transfer to animal food chains under existing site conditions.

6.3 Vegetation Sampling

Specific collection requirements for herbaceous and woody plant species are presented in the following subsections.

6.3.1 Herbaceous Species

Herbaceous species include grasses, sedges, forbs, and other non-woody plants. Samples are collected and processed either as whole plants or as selected plant tissues, as specified in the workplan or SAP.

Whole Plants: If a whole plant is required, manually excavate the entire herbaceous plant from the ground using a hand trowel or shovel while taking care to obtain a majority of the root system. Once the plant is excavated, dislodge loose soil from the roots and rinse the roots with distilled water to remove any remaining soil. Rinse fluids shall be disposed of as specified in the governing workplan or SAP. Place and seal plant samples in appropriately sized and labeled polyethylene bags. Record sample data on the sample analysis request form and on the sampling log (see attachment). Store the samples in a cooler maintained at 4°C or less prior to sample delivery to the analytical laboratory.

Specific Plant Tissues: Specific plant tissues are collected either by cutting the desired parts from the plant with stainless steel scissors or shears or by manually breaking the parts off the plant. The number of plants, the amount of plant tissue, and the sample area is defined in the governing workplan or SAP. Fold, cut, or break sample plant tissues so that the plant tissues fit into a plastic bag. Weigh and store the sample as previously stated. After collecting each sample, decontaminate scissors/shears under the protocols described in Section 6.6.

To collect a root tissue sample, follow the same procedure described above for washing of roots in whole plant samples. As much extraneous soil or substrate contamination must be removed in the field, as possible. Follow similar sample processing and labeling as described for whole plant samples.

If the specific plant tissue requires washing to remove surface dust or contamination, then wash the tissues before cutting them. If retention of investigation derived waste (IDW) is required, all wash and rinse fluids shall be captured and returned to the decontamination staging area for disposal. After shaking off residual wash water, weigh the washed samples, in the field, to the nearest 0.1 gram.

6.3.2 Woody Species

Woody species include trees and shrubs. Samples are normally of specific plant tissues such as branches and leaves of the current year's growth rather than the entire plant since individual plants are too large to be considered for whole-plant analysis. Typically, target plant tissues are leaves, stems, and mature fruits. Specimens for woody species require a minimum 12-inch length of the current year's stem with mature leaves, flowers, and/or fruits attached.

Specific Tissues: Follow the same general procedures for collecting the leaf and stem tissues from woody plants as those described for herbaceous tissue samples. Refer to the workplan or SAP regarding whether to combine or segregate leaf and stem tissues for a single sample. If stems and leaves will be analyzed separately, manually cut, break, or separate the individual leaf from the branch and leaf stem. The leaves would then constitute one sample and the stems, without leaves, would constitute another. Because woody plants are larger and the individuals are more widely spaced than herbaceous plants, the radius of sampling may be significantly larger than the radii for herbaceous plants. Field personnel will consult the governing workplan or SAP for project-specific sampling protocols.

Collect mature fruits such as nuts, berries, drupes, and seeds manually and separately store, label, and process the individual plant types. If required by the workplan or SAP, photograph the fruits as they are naturally attached to the parent plant or attached to a single branch cut from the tree or shrub using a close-up lens.

6.4 Sample Identification

If required by the governing workplan or SAP, a reference specimen of each sampled plant species shall be collected, labeled, dried, and stored in a plant press using standard herbarium techniques. Specimens for herbaceous species require a complete and mature plant that includes at least 40 percent of the root system, mature flowers and/or fruits, stems, and leaves. Specimens for woody species require a minimum 12-inch length of the current year's stem with mature leaves, flowers, and/or fruits attached. If reference specimens are not practical, photographs will be taken of representative samples. Each reference specimen will be assigned an identification number. The identification number, corresponding sample identification number(s), and any reference photograph numbers will be recorded in a field logbook. If species verification is required, the reference specimens or photographs can be sent to others for confirmation of identification.

6.5 Sample Handling

Sample handling procedures and chain-of-custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for vegetation samples are as follows:

- If specified in the site workplan or SAP, a photograph should be taken of the plant and its location.
- Using latex or nitrile gloves manually place the sample into plastic or paper bag
- As each bag is filled, properly seal the bag to minimize the chance of cross contamination.
- Store sample containers in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the workplan or SAP.
- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

During vegetation sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan to minimize cross-contamination.

6.6 Decontamination

Sample acquisition tools shall be decontaminated as follows:

1. Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available.
2. Scrub the sample acquisition tool with a brush and rinse with deionized or distilled water.
3. Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.
4. Wrap the decontaminated device in clean plastic sheeting or bags and tape securely pending next use.

7.0 RECORDS MANAGEMENT

The attached Vegetation Sample Collection Form is to be completely filled out for each corresponding vegetation sample. This form should be reproduced in a field book along with any notes or unexpected events that may accompany the effort.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

The approved quality assurance and quality control measures will be applied as described in the applicable workplan or quality assurance project plan.

VEGETATION SAMPLE COLLECTION FORM

Project: ________________________________

Project Number: ______________________

Date: ________________________________ **Time:** __________________________

Name of Field Personnel: ______________

Signatures: _________________________ ______________________________

SITE DESCRIPTION

Study Area: South Idaho Phosphate Resource Area

Site Location: _______________________________________

Facility Location: ____

Station Number: ____________

GPS Coordinate: ____

Subquadrant Coordinates: x-coordinate: ______________ y -coordinate: ____________

Approximate Slope Angle (circle): 0° - 10° 10° - 30° 30° - 40° > 45°

Aspect (direction of slope): N NE E SE S SW W NW

Vegetation Ground Coverage: < 25% 25% - 50% 50% - 75% > 75%

Notes (plants of interest):

____

____

____

SAMPLE DESCRIPTION

Sample Identification Number: ___________________

Sample Type (circle): whole plant stem leaf

Sample Genera: ____

Sample Weights: Tare ______________

Total _____ _____ _____ _____ _____

Net _____ _____ _____ _____ _____

Notes: ____